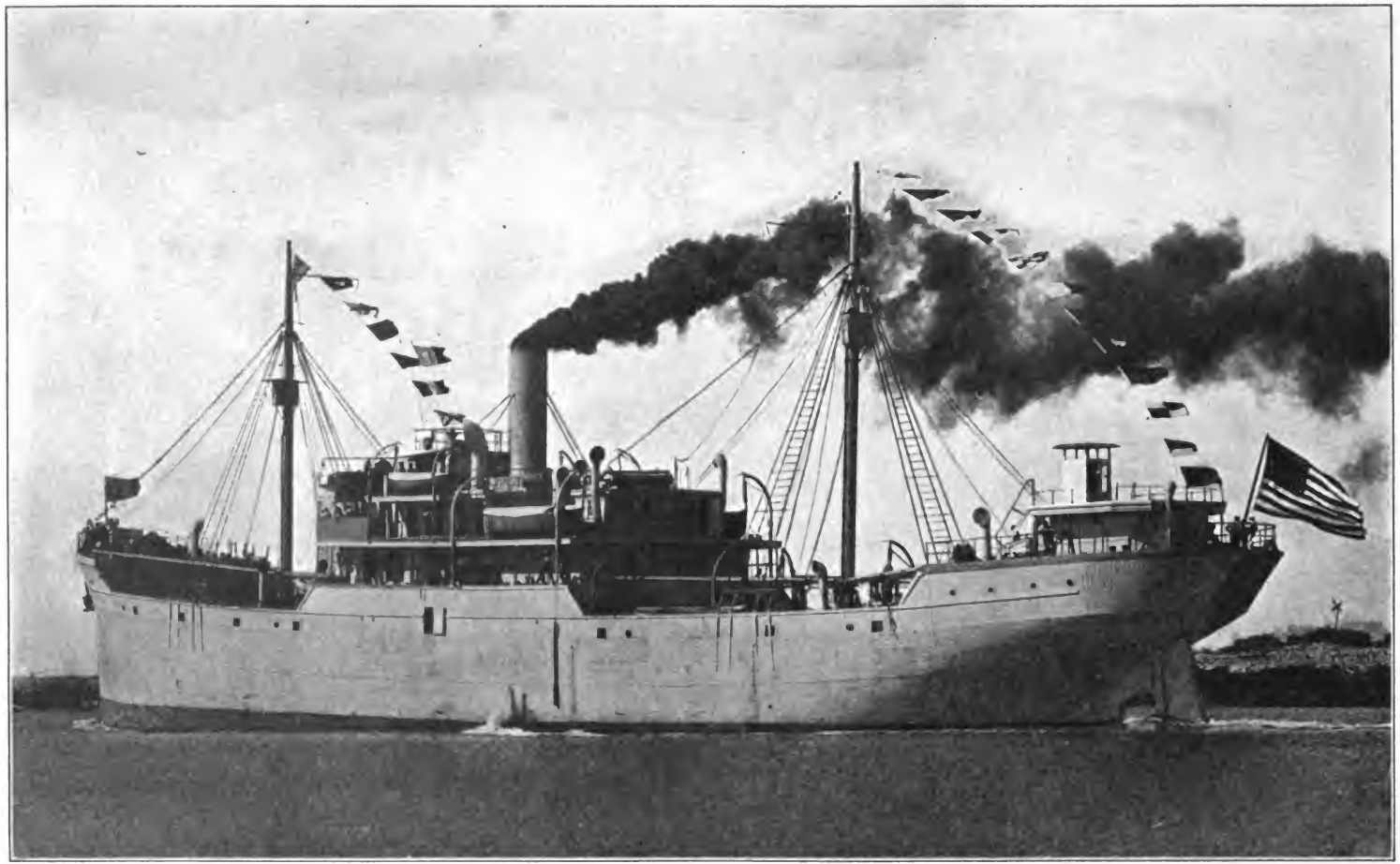

Fig. 1—A standard wooden steamship for the United States Shipping Board Emergency Fleet Corporation, Ferris-type

UNITED STATES SHIPPING BOARD
EMERGENCY FLEET CORPORATION

THE BUILDING OF A WOODEN SHIP

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THE BUILDING OF A WOODEN SHIP

PARTS OF A WOODEN SHIP

Any new job seems complicated at first, and the building of a wooden steamship is no exception. A ship in process of construction, with all the scaffolding around it, looks exceptionally complicated, but it appears much simpler when one becomes acquainted with the names of the various parts. One of the most confusing things about shipbuilding to the new hand is the fact that so many new terms are used. I find I have used one already when I said "new hand." On a ship a man is referred to as a "hand." If an officer says, "All hands lay forward," he does not mean that all the men are to go and lie down. He means that all the men are to walk toward the front end of the ship.

A ship is built to float and propel itself through the water. If it were built square like a house it would make very little progress. Therefore, it is made long and narrow with the ends pointed. The front or *forward* end is called the *bow;* the back or *after* end is called the *stern,* and the middle portion is called *amidships.* If you stand at the stern of the ship and walk forward, the side of the ship on your right is called the *starboard* side, and that on your left the *port* side. In walking from the after end of the ship to the bow you are going *forward,* and in walking from the bow to the stern you are going *aft,* but if you walk across the ship from side to side sailors say you are going *athwartships.*

The various floors in a ship are known as *decks.* The space between the bottom of the ship and the lower floor or deck is called the *hold,* and is used for storing the *cargo* or freight which the ship is to carry. The spaces between the lower deck and the upper deck are called the *tween-decks*—an abbreviation of between decks—and are also used to store cargo. The holes in these decks, through which the cargo is lowered, are called *hatches* or *hatchways.* The walls or partitions which divide the inside of the ship into rooms or compartments are known as *bulkheads.* The boilers, engines and other machinery are always separated from the holds, where the cargo is stored, by bulkheads.

DESIGNS AND PLANS

The building of wooden ships varies in details according to the shape, just as in the building of houses. A flat-roofed house has its timbers cut differently from a peaked-roofed house, and ships vary in a similar manner. The design of a ship, as shown by its plans, governs in a great measure the method to be followed in its construction. We will take as an illustration the Ferris design of wooden steamship of 3500 tons *D. W. C.* (dead-weight capacity) of which so many are now in course of construction. These plans were first drawn by the naval architect, who figured out that after deducting the space which the propelling and other machinery would take, there would be room to *stow* inside of her holds 3500 tons of cargo. This is her *tonnage,* or *D. W. C.,* as it is called. Her *displacement,* also expressed in tons, is something entirely different and means the weight of the water displaced by the ship. Since a cubic foot of salt water weighs about 65 pounds, the number of cubic feet of water the hull displaces multiplied by 65 and divided by 2240 gives the

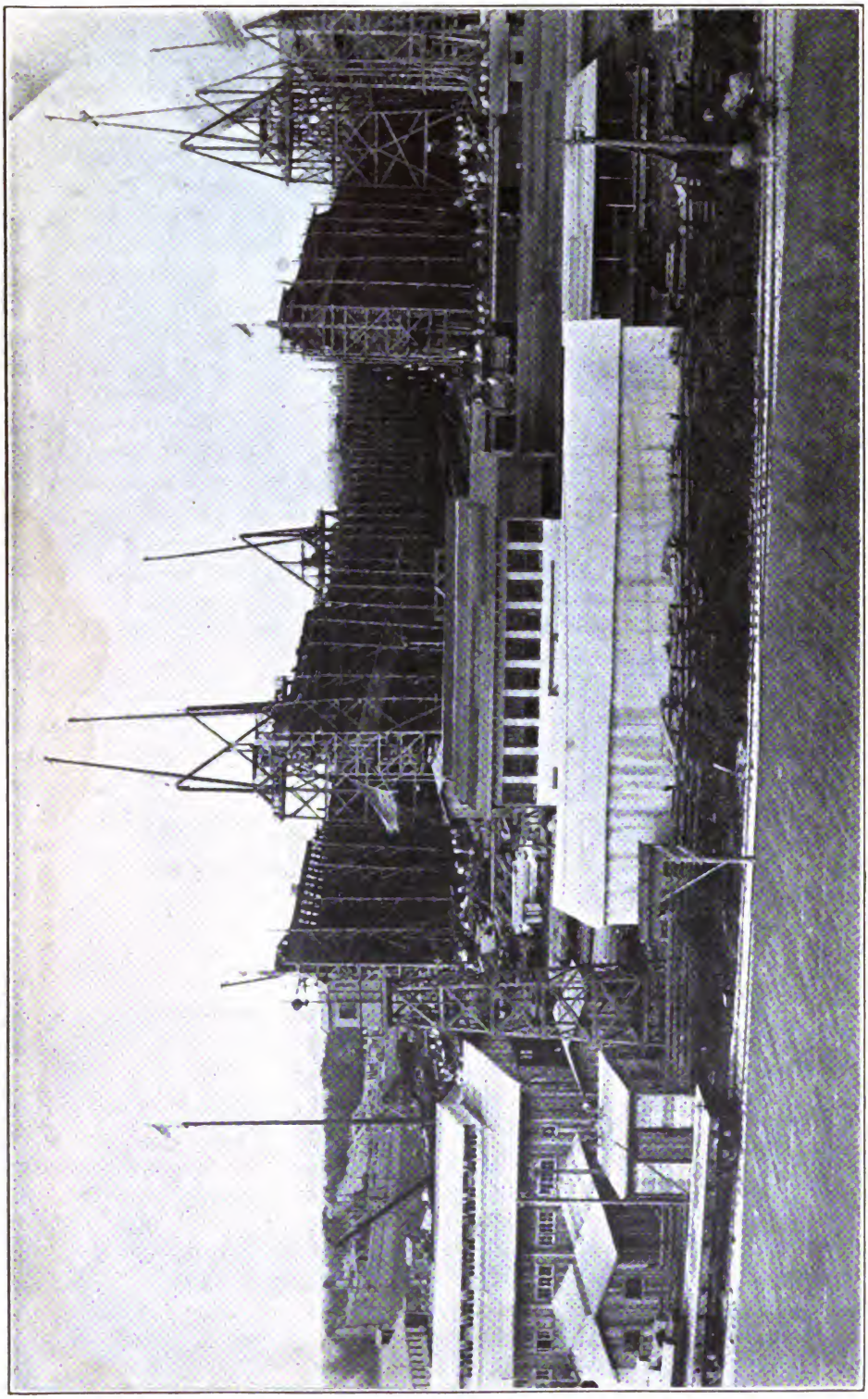

Fig. 2—A wooden shipyard showing four ships on the ways, two ships afloat, and shops in the foreground.

displacement in gross tons. This is the same as the weight of the ship, stores, and cargo and varies with every pound put aboard or taken off.

The measurements of each of the lines representing the shape of the ship, as it would be if sawed into layers from end to end horizontally and vertically, and also as it would be if sawed across at intervals along her length, are taken off and tabulated by the naval architect into what is called a *table of offsets.*

THE MOLD LOFT

With this set of measurements, the man who is called the *loftsman* or *mold-loftsman* and who is going to *lay down* the ship, reproduces in full size the lines of the ship on a clean, smooth, board floor and *fairs up,* or corrects, any errors due to enlarging so small a drawing. The room where the plans are reproduced is called the *mold loft,* as it is here that the *molds* or *patterns* are made from which the shape of each piece of wood may be marked out on the timber from which it is to be cut. The molds are made of white pine, seasoned stock preferred, ⅝ or ¾ inch thick. They were formerly made solid in wide boards called *solid molds,* but nowadays *skeleton molds* are made of narrow slats with cross braces, which give them strength and lightness so that they can be more easily handled and make them less likely to warp.

As the pieces of wood are needed at the ship the mold loftsman takes each mold and marks out the timber for the sawyers to cut. In marking or scribing the timbers, *a race knife* or *scrieve knife* is used. This knife has a narrow U-shaped blade that cuts out a groove about ⅛ inch wide. This cut-out line may be readily seen though the timber may have been marked out a week or more before it is used.

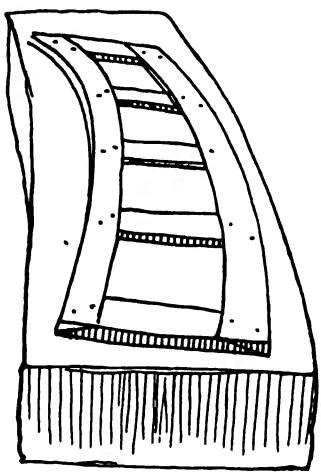

Fig. 3—Mold laid on timber.

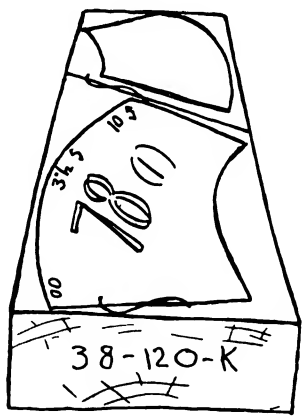

Fig. 4—Timber after mold's shape has been marked upon it.

ERECTION ON THE WAYS

While the shape of the ship is being drawn out or *laid down* and the molds are being *picked up* off the mold loft floor, other men are preparing the place on the water's edge where the ship is to be built. In some places the ships are built parallel to the water's edge and slid or *launched* sideways into the water. The advantage of this method is that the ship may be built level just as she is to float in the water, but the disadvantage is that it takes up a great deal of room along the valuable water front and is considered more dangerous. In most cases the ships are built stern foremost at right angles to the water's edge.

ARRANGEMENT OF KEEL BLOCKS

If the ground is sufficiently solid no foundation will be required other than to bed down the cross timbers, thwarts or caps, on which the keel blocks are to be laid level with the top soil. If the ground is soft or if it has been recently filled, piles must be driven to support the weight of the ship under construction. The piles are sawed off to a carefully surveyed grade and are capped with cross timbers.

On top of these cross timbers are placed heavy wooden blocks, called *keel blocks.* (See Fig. 26.) The keel blocks are both cribbed-up; that is, laid criss-cross like the logs of a log cabin, and also laid one on top of the other. In the latter case they must be braced to prevent being rolled over as the ship's weight increases. The keel blocks should be built up plumb and must not be too wide so as to interfere with the borings for fastening the first plank next to the keel or with other building operations at the keel and bilges.

The keel blocks are laid to the proper grade by stretching a wire or cord between fixed points, determined by direct measurements or by means of an engineer's level. The slope or grade at which the keel blocks are laid varies in different yards from ⅜ inch to 1 inch per foot. The top block should be bevelled to the grade so that the keel lies evenly upon it. The top block may be fitted up with shallow wedges to facilitate removing in order to rivet up bolts and to put in place the oak wearing strip or *shoe* that goes on the underside of the keel. In some yards the keel blocks are dowelled together, in others they are held in place by iron staples, called *dogs,* or by wooden battens spiked on each side of the blocks; and in others they are not fastened at all but are held in place by the weight of the ship. In the latter case, the keel blocks can easily be removed, piece by piece, when the ship is about to be launched.

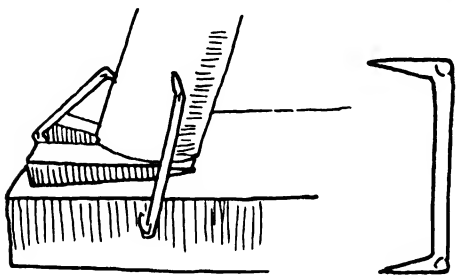

Fig. 5—Timber Dogs.

THE KEEL

The keel is the backbone of the ship and supports the *frames* as the backbone of a fish supports its ribs. As it is impossible to get a wood timber long enough to make a keel in one piece, several pieces are joined together lengthwise by *scarfing* or tapering the ends and lapping them and then fastening or riveting the two together. When all of the various pieces necessary to make the keel the proper length have been scarfed and carefully fitted they are hoisted or rolled on inclined timbers to the keel blocks. The surfaces of the scarfs are then painted and fitted together.

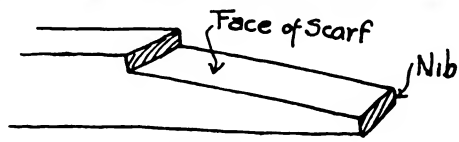

Fig. 6—Scarf.

Scarfing timbers together is one of the most important processes in wooden shipbuilding and deserves detailed explanation.

The length of the scarf is shown in the plans or specifications and is usually given to the workmen by the foreman who lays out the work. The foreman also

tells the workmen the depth to make the pointed end or *nib,* as it is called, but if he does not, 23 per cent., or about one-fifth the depth of the timber, is a safe rule to cut to. Care must be taken not to run the saw out any deeper so as to make a weak spot where the timber may split when bent. The scarf is first marked out on the timber and is then sawed out on a band saw or circular saw. If neither is available a 5-foot or 6-foot cross-cut saw may be used and several saw cuts made and the chunks of wood spilt, chopped, or dubbed out with a broadaxe. The timber is then trimmed or dubbed off carefully to the line on the face or working side of the timber with an adz. The remaining wood is then worked off, using the carpenter's square frequently to see that too much is not cut away. The face of the scarf is finished off with a plane so that the carpenter's square fits perfectly on its face when applied at various points across it.

There are several kinds of scarfs; the plain scarf, flat scarf, hook scarf, lock scarf, etc. The plain and flat scarf are the ones most commonly used and the hook scarf comes next. The lock scarf has an opening in which is driven an oak wedge or key for the purpose of keying and setting the ends of the scarf tightly together. The keel scarf with tenons is a combination of the plain and hook scarf and is more difficult to cut and fit. To prevent pulling apart short wooden pins, called *dowels,* fitted vertically in the face of the scarf, were formerly used, but nowadays the more common practice is to bore across at the seam where the two faces meet and drive in *treenails,* long wooden pins about the size and shape of broom handles and usually made of locust wood. Sometimes a better fit can be obtained by running a cross-cut saw through the joint. When the surfaces fit perfectly with their nibs or ends pushed tightly together by means of a jack at one end, they are either clamped together with big iron screw clamps or are wrapped with chains with wedges driven between the chains and the timber so as to draw the wood tightly together. (See Figs. 20, 22, 23.)

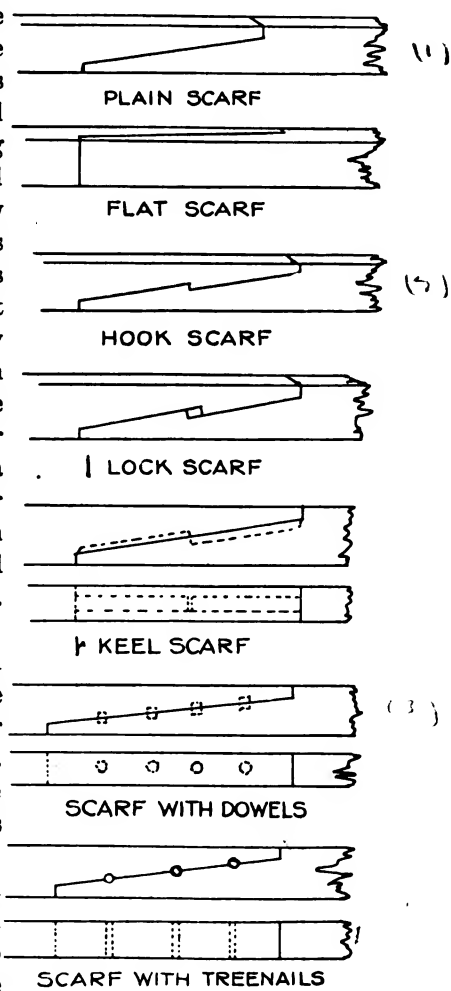

Fig. 7—Different types of Scarfs.

Vertical holes are bored and iron or steel clinched fastenings and treenails are driven by the use of compressed air tools—air drills and air hammers. In some yards electric drills are used. Where air or electric tools are not provided the holes are bored with hand augers and the dowels and treenails are driven by sledge hammers. Where air tools are available a special air hose, an air drill, and a long ship auger, about 1/16-inch less in diameter than the iron bolts or treenails to be driven, are used. The air which operates these tools is carried about the yard through compressed

air pipe lines similar to gas or water pipes. Hydrants or cocks for attaching the hose are provided at convenient distances apart. The supply of compressed air is obtained from an air compressor in the engine room of the shipyard. The air compressor discharges the compressed air into large steel storage tanks and into air pipe lines leading to the hulls under construction or to any desired location in the shipyard or shops.

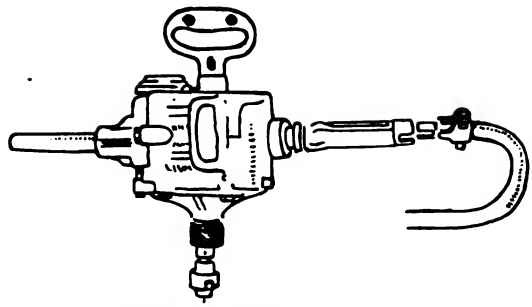

Fig. 8—Air Drill.

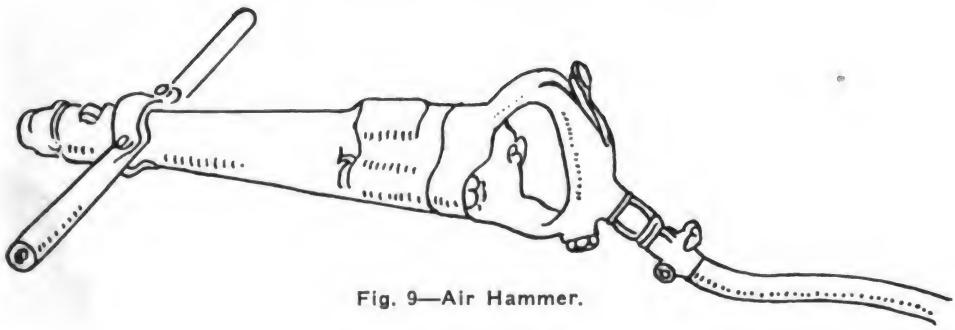

Fig. 9—Air Hammer.

Air drills are small motors run by compressed air and can easily be carried by one man. They are operated by connecting the air hose with which they are equipped to the nearest convenient connection on the compressed air pipe line; an auger of the desired size is inserted and secured in the revolving chuck at the base of the tool; and the point of the auger is placed on the location for the hole. The tool is started and operated by turning one of the handles opening the air valve, the compressed air flowing in from the compressed air pipe line through the air hose and into the air motor, which is started and revolves the chuck and auger. Air drills are usually reversible and have variable speeds. The speed is increased or decreased by controlling the volume of air flowing into the motor with the operating control in the handle.

Where electric drills are used the operating power is an electric current. Electric feed wires take the place of compressed air pipe lines and hose. The feed wires are led to convenient points and outlets are installed to which a flexible electric cable, with which the electric motor is equipped, can be attached. The motor is started and stopped by turning one of the handles which operates an electric switch. The auger is attached to the chuck in the same manner as in the air drill and the chuck is revolved by the electric motor. The electric drill has some advantages over the compressed air tool in that it is lighter and more easily installed. Feed wires can be put up quickly in any location, whereas compressed air lines are installed at considerable expense. The cost of compressing the air for a given power is much more than the cost of generating electric current. On the other hand the electric drill is a comparatively new tool and has developed some faults.

Air hammers are operated by connecting the flexible air hose with which they are equipped to the nearest convenient connection on the compressed air pipe lines. The *set,* or loose piece of steel inserted in the end of the hammer farthest from the operator's hand, is placed on the end of the bolt, fastening, treenail, or rivet to be driven, taking care to keep the hammer in line with the center line or long axis of the fastening to be driven. When the hammer is in position, it is started by pressing a small lever or trigger in the handle. This lever opens a valve, allowing the air to flow into the hammer-operating mechanism. This flow of air operates a steel plunger or piston, which moves back and forth in a small cylinder or barrel at great speed. The outer end of this plunger strikes the set secured in the end of the hammer. The operation of driving is performed by the powerful rapid blows of the plunger against the set which transmits the force of the blow to the fastening to be driven. The speed or force of the blow can be controlled by the operator by pressing firmly or lightly on the lever in the handle, thus opening or closing the air valve and increasing or decreasing the volume of air.

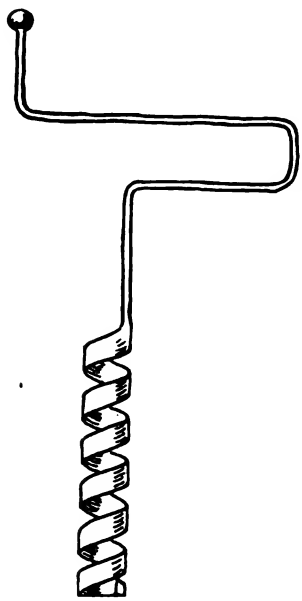

Fig. 10—Hand Ship Auger.

Where no air tools are provided, holes are bored by hand augers. The bit or cutting end of the auger is welded to a long bar of iron, which is bent to form a crank for turning it by hand. Ship augers or bits are of two kinds; one has a small screw point called a *worm* or *tang end;* the other, known as a *barefoot* auger, is without this small screw point. Barefoot augers are most commonly used because they bore a truer hole and can be pulled out easily to remove the chips or cuttings. This has to be done very frequently to prevent the bit from getting choked and stuck in the holes. A box or shallow can of grease into which the point of the auger may occasionally be dipped will be found useful if one has many holes to bore, as the auger works more easily when lubricated frequently.

Fig. 11
Worm or Tang Auger.

Fig. 12
Barefoot Auger.

In using hand bits care should be taken not to bear too much weight on the bit or attempt to crowd it down into the wood. It is the turning of the bit that cuts the hole, not the pressure put upon it. After pulling the bit up to throw out the chips it should be put back in the hole carefully and not allowed to drop down and hit the bottom hard; this will ruin any auger. If an auger gets stuck so that it cannot be turned back out of the wood, a stilson wrench should be used. A hand auger can be taken out by tapping the underside of the crank handle, but with a straight shank auger, such as is used in air drills, it may be necessary to use a

shackle bar, a crow-bar with a link of chain on its end. In using a shackle bar care should be exercised not to bend the auger shank, as this may damage it beyond repair. Experience has shown that the worm part of the auger need not be more than 18 to 24 inches long. Holes of any depth can be bored with this length of worm successfully and quickly, when welded to a straight shank, if the men are instructed properly about cleaning out the chips from the hole.

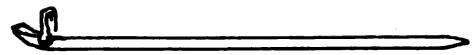

Fig. 13—Shackle Bar.

The keel is generally laid down with its bottom surface a straight line from stem to stern. This is always so when it is known that the design of the *hull* gives a rigid structure, or when it is believed that the workmanship or the fit of the hull timbers and planking will be good. If, however, it is thought that the design of the hull will be such that there may be some flexibility in the hull as a structure or that the workmanship in the hull may be poor, the keel is laid with a *center-sag.* The sag is measured by taking the vertical height at the maximum point of curvature to the *chord,* wire or straight line drawn from the stem to the stern at the keel. The sag varies according to the judgment of the master shipbuilder from 2 to 11 inches in a keel 280 feet in length.

The reason for laying a keel with a sag is apparent when you consider the shape of the ends of most sea-going vessels. These are usually built fine or wedge-shaped to allow the vessel to go through the water with the least possible resistance. The wedge shape of the bow or stern is such that it does not offer much buoyancy to the hull and, as the weights carried here are very heavy, the ends of the hull tend to sag. The center-sag in the keel is an attempt to counteract this tendency of the ends of the vessel to sag after she is afloat and completely equipped.

STEM, STERN-POST, AND FRAMES

The distances between the frames or ribs, measured from center to center, and the location of the stem and the stern-post are carefully laid off on the keel. The stem (see Fig. 29) is the upright timber at the front end or bow of the ship, and the stern-post (see Fig. 31) is the upright timber at the after end of the enclosed part of the ship. There is a certain amount of solid wood built up in layers and bolted together, called the *deadwood,* at each end of the vessel and also a large knee or piece of timber having a natural crook, used for the purpose of strengthening the corners formed by the keel at the stem and the stern-post. (See Fig. 31.)

A few frames at each end of the ship do not cross the keel. Such frames are called *cant frames and half frames.* The rest of the frames that go across the ship from side to side are known as *full frames* and are of two kinds. Those near the ends where the ship grows wider and wider as they approach the midship section are called *bevel frames,* as their outside surfaces are cut to a bevel. For a certain distance in the midship section of the ship the frames are all of the same size and shape and, as their outside surfaces are cut perfectly square, they are known as *square frames* or *dead flat frames.*

In small boats the frames or ribs are made of one piece of wood steamed and bent to the required shape, but in large cargo ships the frames are *built up* of many

pieces. These pieces are laid around to the required shape in two layers, one layer overlapping the joints of the other and all are dowelled or *fastened* together with treenails. (See Figs. 15 and 70.)

The loftsmen, having made wooden molds or patterns giving the shape of every square or bevelled frame, mark out the finished shape desired on the various pieces of timber to be shaped for such frames. (See Fig. 3.) Each of these pieces is numbered with the number of the frame it belongs to and the number of the piece. The frames are numbered from the aft forward. The pieces of the frame are numbered from the keel to the top and are also marked so as to show whether they go on the starboard or port side of the frame.

Some frames are composed of as many as eight or ten pieces in each layer. The first two pieces lie directly across the keel and are securely fastened to it. These pieces are called the *floors*. The other pieces are built up from these floors around

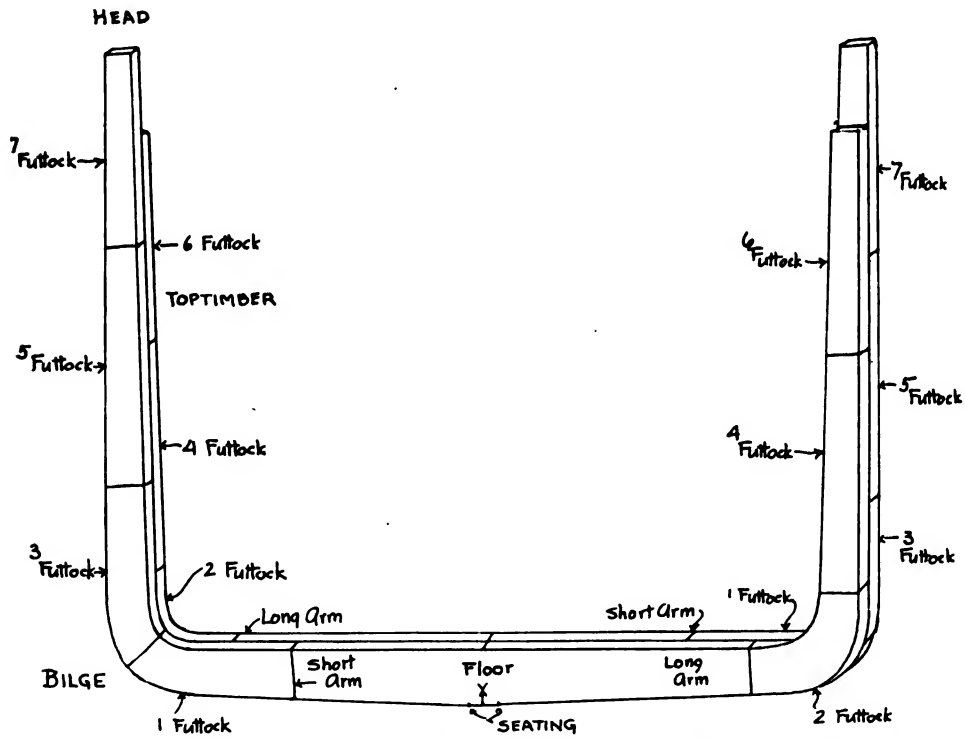

Fig. 14—A transverse frame in the square body showing the names of various parts of which it is composed.

the bilge and the sides and are called the *futtocks*. The loftsman indicates the exact position where the joints are to come by *sirmarks*, and marks the angle of bevel at which they are to be cut at intervals along the inscribed molded surface as drawn on each piece. These pieces of timber are then taken to the saws and are sawed out on *ship-saws* or *bevel band saws* or *jig-saws*, the operator setting the saw blades to the angle marked on the futtocks they are to cut, changing this angle gradually to correspond with the marks indicating the bevels desired. The molded dimen-

Fig. 15—Sketch showing under and standing bevels on futtocks.

sions are given to the center line of each frame. If there are six futtocks or pieces to a frame there will be six under bevel pieces and six outward or standing bevel pieces; if the fourth futtock on the forward side of the frame has an under bevel, the fourth futtock on the after side will be cut with an outward or standing bevel. This is one of the most intricate processes in shipbuilding.

The loftsmen keep a record of the pieces of each frame which have been molded or marked out. As the timber comes to them from the cars or lumber storage yard, they mold it according to the item number for that part of the frame to which that particular width or length of timber is best adapted. The item numbers are hammer stamped on the timber by the lumber inspector at the mill. Very wide, long pieces are required for floors and very wide pieces for the crooked shape at the turn of the *bilge,* as the rounded portion of the hull between the bottom and side is called. The pieces diminish in size in the *top timbers* or the vertical part of the frame, or *straight,* and are somewhat smaller in one dimension at the top. Across the bottom or floor of the ship, the frames may be twice as thick or deep as they are in the sides at the top, but the width or fore and aft dimension is the same all the way up.

ASSEMBLING THE FRAMES

To see all these crooked sawed futtocks is confusing, but by picking out all of the pieces which belong to the same frame and arranging them according to the numbers marked, one finds that what looks like a jig-saw puzzle is not so difficult

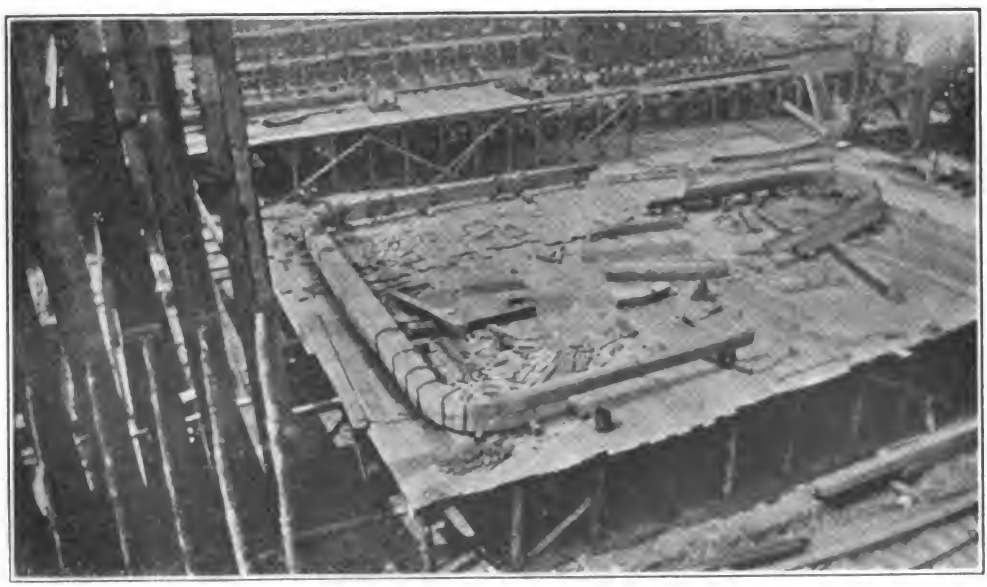

Fig. 16—Framing Platform.

after all. Men who never saw a ship under construction have become expert framers within a week or two. The frames are sometimes assembled on a temporary platform built across the top of the keel and large enough for men to work around a full-sized frame when laid out flat. If made large enough two gangs of men can work upon this platform putting frames together and setting them up at each end of the ship. An alternative method is to build the platforms off to either side of the ship's keel or at the bow or stern. The frames are lifted and swung into position on the keel by cranes, derricks, gin poles, block or purchase tackle.

When assembled, a complete midship frame for a 3500 D. W. C. Ferris-type ship is about 45 feet wide and 30 feet deep. The big sawed and shaped timbers used in building the frames are lifted by a crane or other mechanical device and placed on the platform, one on top of the other, so that their center marks correspond. Short blocks of wood are placed under the timbers so that the chain slings, timber hooks or tongs, by which the timbers were lifted may be removed and each piece levelled and trued into position by driving wedges under it.

The two parallel timbers of the frame are fastened together by boring several holes with a 1¼-inch auger and air drill and driving into these holes dowels or treenails with air or sledge hammers. Metal caps or protectors are sometimes placed over the heads of dowels or treenails to prevent the hammer from splitting them. These caps are made from 3-inch square bars of iron or steel about 6 inches long with holes drilled in one end so that they will slip easily over the treenail. If a treenail becomes jammed in the cap, the treenail should be sawed off and the cap put in the blacksmith's fire for a few moments so as to burn out the wood. If a treenail breaks off when it is only part way through, the broken part may be removed so that a new treenail can be put in, by using an iron bar, about 30 inches long and ¼ inch smaller than the diameter of the broken treenail, called a *drift pin*. The point of the treenail should be dipped in grease or creosote so as to make it drive easily, but the size (diameter) of the treenail should be such that it will fit as tight as it can be driven without breaking.

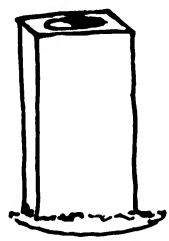

Fig. 17—Treenail Cap.

It would be an awkward proceeding to have to turn a frame around after it was all put together. This can be prevented if one is careful when assembling the frames to get the bevels right. With the floor of the frame pointed towards the end of the ship where it is to set, the standing bevel piece should be underneath and the under bevel on the top—the bevels always being determined from the face where the two meet. By so doing the narrowest edge of the frame will be towards the proper end of the ship. The bevels on the floors at the center are so slight that it is difficult to tell which way the frame goes. At the keel the frame is absolutely square, but commencing at the round of the bilge the bevel is more perceptible. When the next frame with more curve to it has the first futtock fitted, the bevel is more pronounced. The bevels on the forward and after futtocks of a frame are just opposite, one slanting out and the other in. Reference to Fig. 15 will show clearly the meaning of standing or under bevel. The first futtock on the port side is the same shape as the first futtock on the starboard side, except that the bevels are reversed or sawed opposite hand.

The futtocks are lifted, pushed into place, and wedged snugly against each other by the use of the cant hooks, carrying hooks, and crowbars. The *head* and *heel,* as the ends of the futtocks are called, must fit perfectly. This is done by

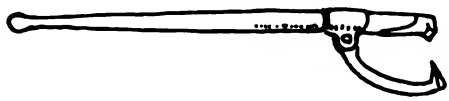

Fig. 18—Cant Hook. When this tool is provided with a spike in the hook or metal socket end of the staff, it is called a (peevy, peevey).

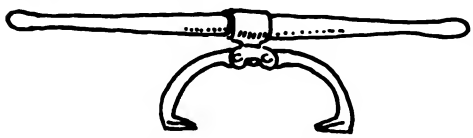

Fig. 19—Carrying or Timber Hook.

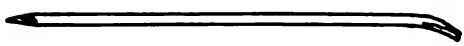

Fig. 20—Pinch Bar.

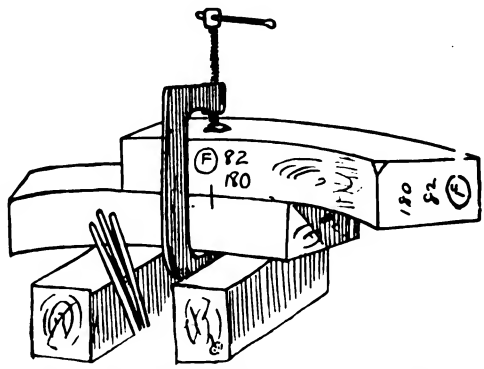

Fig. 21—Clamping floors for a frame.

running a cross-cut saw between the ends and driving them together with a sledge hammer. The two pieces are then drawn tightly together by means of large iron clamp screws, or by wrapping chains around them and then driving wedges between the chains and the timbers. These chains are made of ⅝ or ½ inch iron with oval links, with an elongated pear-shaped

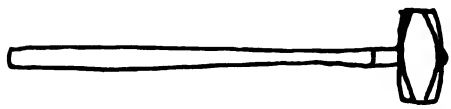

Fig. 22—Sledge Hammer.

Fig. 23—Frame chained together.

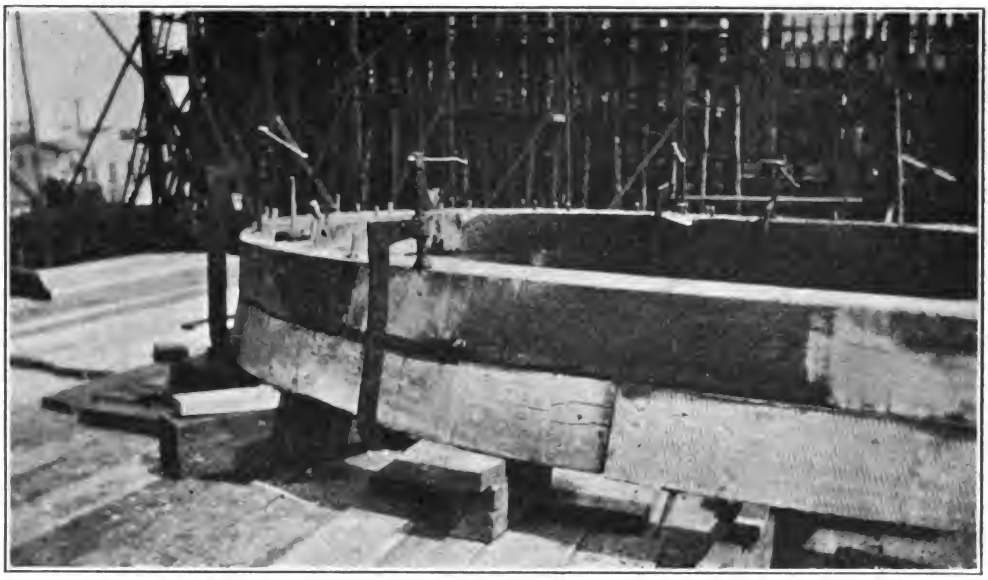

Fig. 24—Frame clamped together.

link on one end, called a jew's harp link from its peculiar shape. The chain passes freely through the upper enlarged part of this link, but jams in the other narrow part, thus permitting the chain to be adjusted quickly and secured so that it will not slip.

In order to have the frame exactly alike on both sides, a *batten* representing the central line of the ship is laid off square to the bottom of the frame and from predetermined points on the batten the distances to the various futtock heads are tested by another batten on which these measurements have been marked off from the mold loft floor. Each side of the frame is tested in this manner. When possible, use a steel tape in ship measurements.

Care should be taken to test the frame with a breadth batten on the center line, the line between the two halves of the wooden frame. This is especially important when setting bevel and half cant frames. Where several ships are to be built from the same plan a saving can be made in the cost if the molds, spalls, harpins, ribbands, breadth battens, horning battens, angle boards, knee molds, bevel boards, any template pattern, special measuring, or marking devices are painted with a distinctive color all over. They are often thrown down on the ground near where the hull is being assembled and unless distinctively marked may be picked up and thrown into scrap timber or cut up to be used for some other purpose.

At each futtock joint four holes are bored, two each side of the joint, through the upper and lower halves of the frame, and treenails are driven in.

To prevent the collapse of the frame when raising it upright onto the keel, braces called *cross spalls* are *lagscrewed* fast to the frames from side to side, one just along the mark on the frame indicating the height of the top of the upper deck beams, and another a couple of feet below the hold beam or between-deck line. The heights of these floor or deck levels and the location of the joints between the various

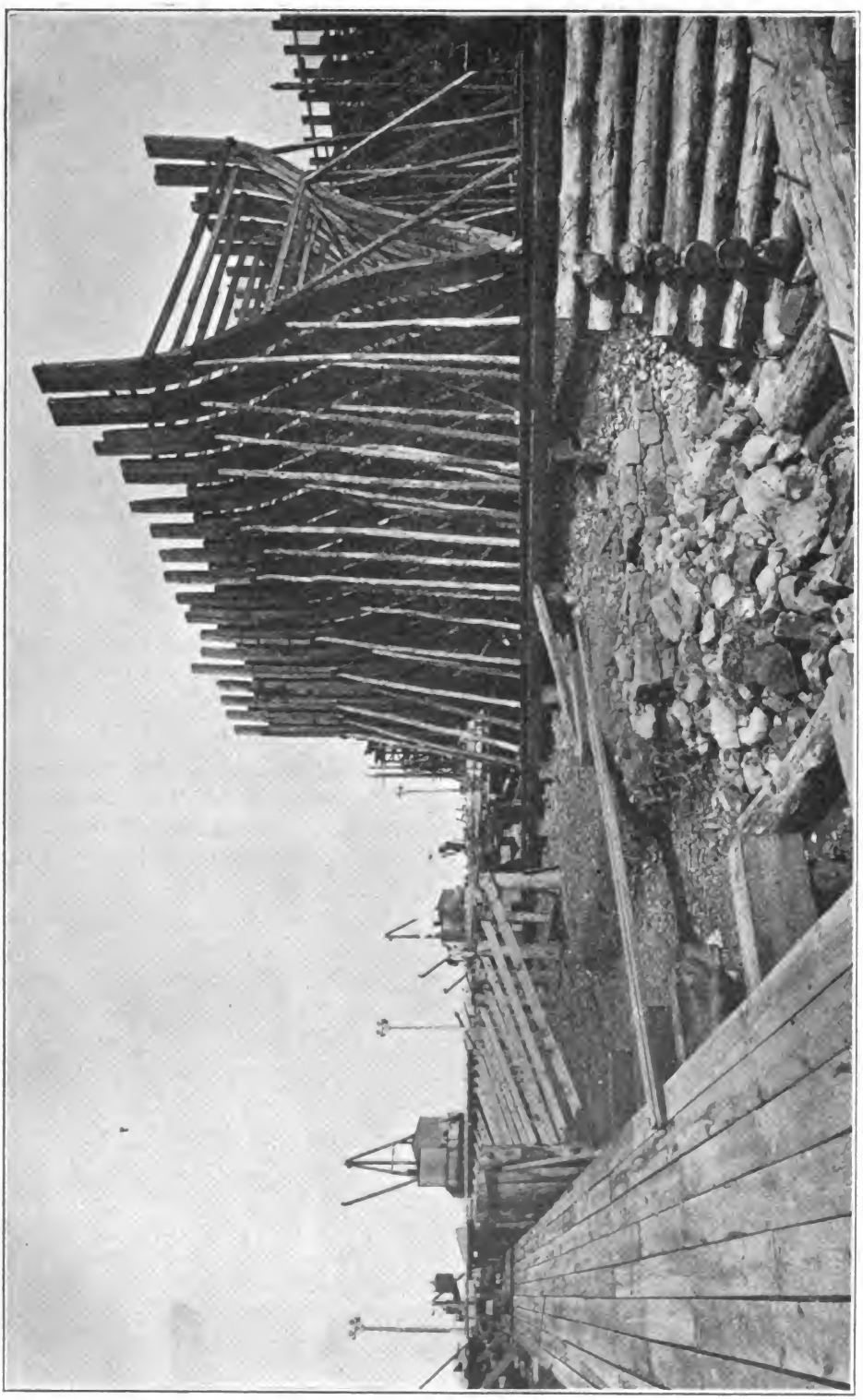

Fig. 25—Erecting the frames.

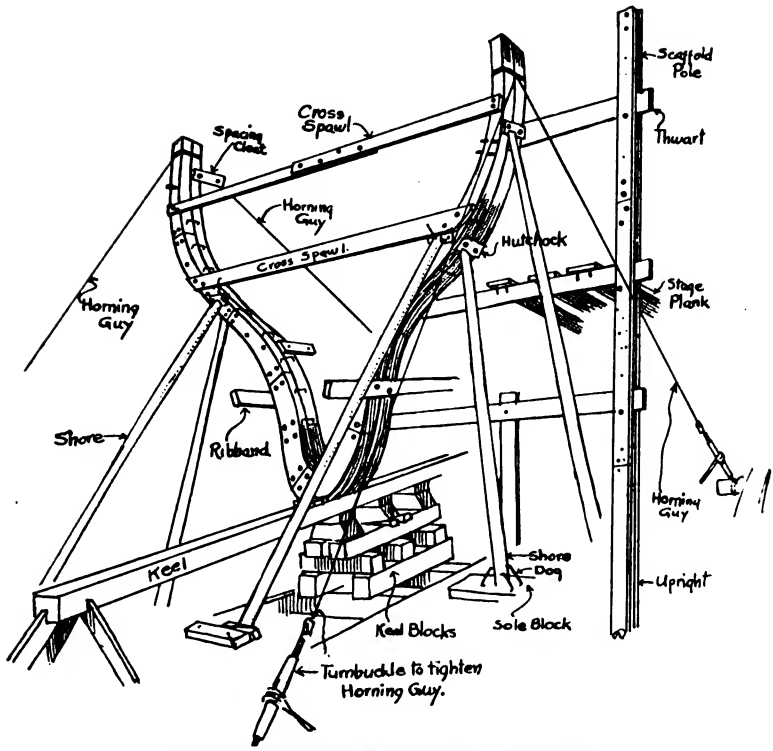

Fig. 26—How the first frame is erected.

pieces of futtocks constituting a frame are marked from the molds when the timber is laid out. These marks are cut or scribed in the edge of the frame with a race knife or saw so that they will show on the edges after the two molded faces of the frame are fastened together and thus serve as a guide for running in the fore and aft lines of the ship when all of the frames are erected. A butt dowel—put diagonally through from one futtock to the other on the face or outer edge of the frame—tends to prevent the *racking* or straining of the frame when it is raised into position. As an extra precaution, chains are wrapped around the frame and wedged up tight at each joint, or sometimes iron dogs are used. These are all knocked off after the frame is set up and secured in position.

ERECTING THE FRAMES

The question as to which frame shall be set up first is determined by the master shipbuilder. One method is to start at the middle of the ship and work in both directions towards the ends; another is to start at the ends and work towards the middle. (See Fig. 23.) In some cases the available material on hand determines this. If all the timber needed for the whole ship's frame is on hand the less experienced men can be erecting the middle portion of the ship's framing; that is, the square body which is all the same and has no bevels. Meanwhile the more experienced men can be getting out the bevel frames, each one of which is just a little different in shape from the others. If the larger sizes of timber necessary to build

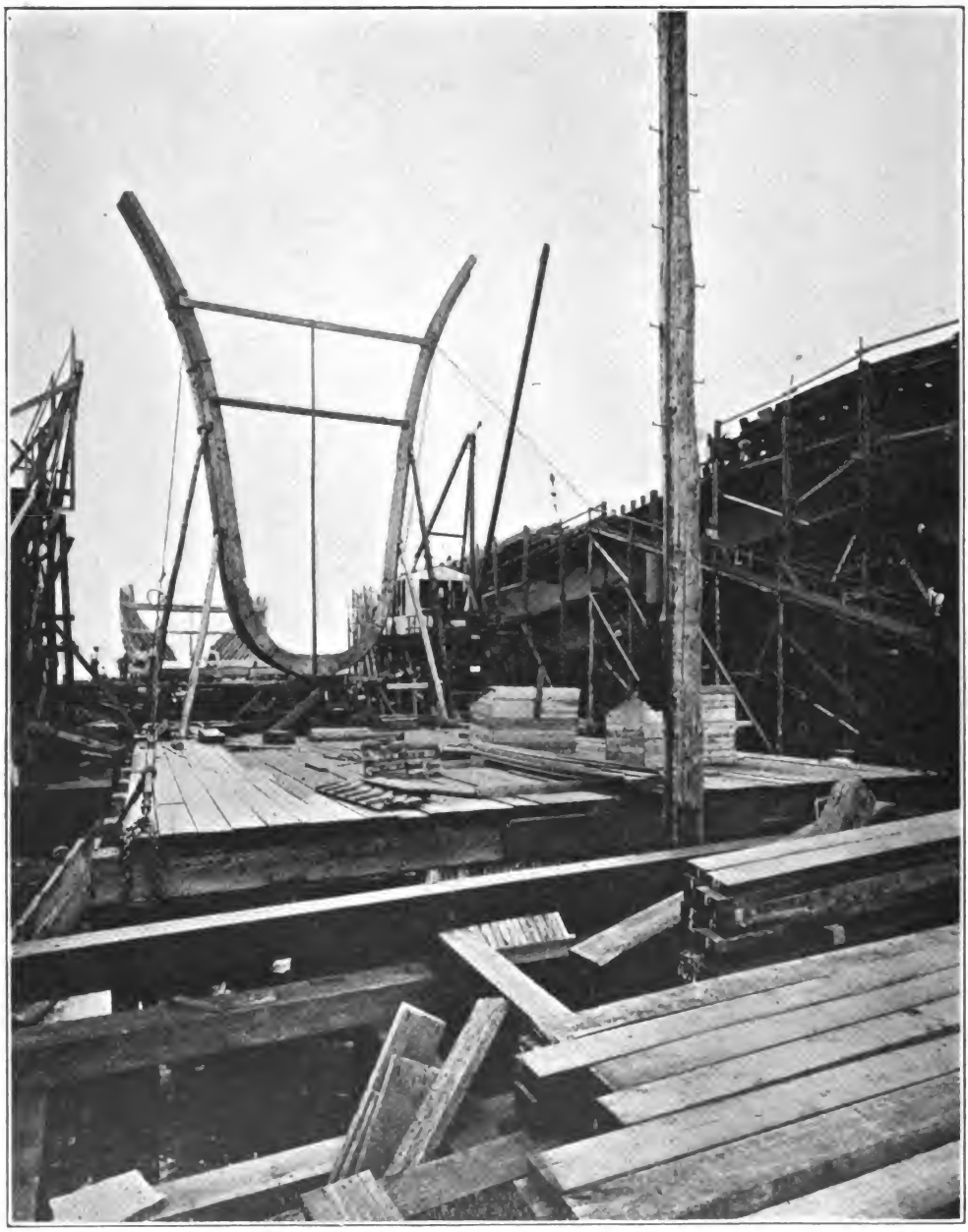

Fig. 26A—The first frame erected in position on the keel.

the wide midship frames are not on hand, the two ends of the ship may be framed first using the smaller sized timber.

If the yard is equipped with powerful cranes the frames are lifted and swung into place upon the keel. If no cranes are available the frames, after being assembled on the platform, are slid along the keel on sliders or greased timbers until they are in the desired location for erection. The top of the frame is raised into position by means of purchase tackles fastened to the top of the frame previously erected. The first frame is raised by tackles from the tops of the two poles, called *gin poles,* set up each side of the keel and held secure by temporary guy ropes.

The first frame to be set up must be held securely in position. To do this, *chocks* or *hutchocks* of wood with notches cut in them to receive the ends of shores are *lagscrewed* fast to the upper part of the outer face of the frame and also about

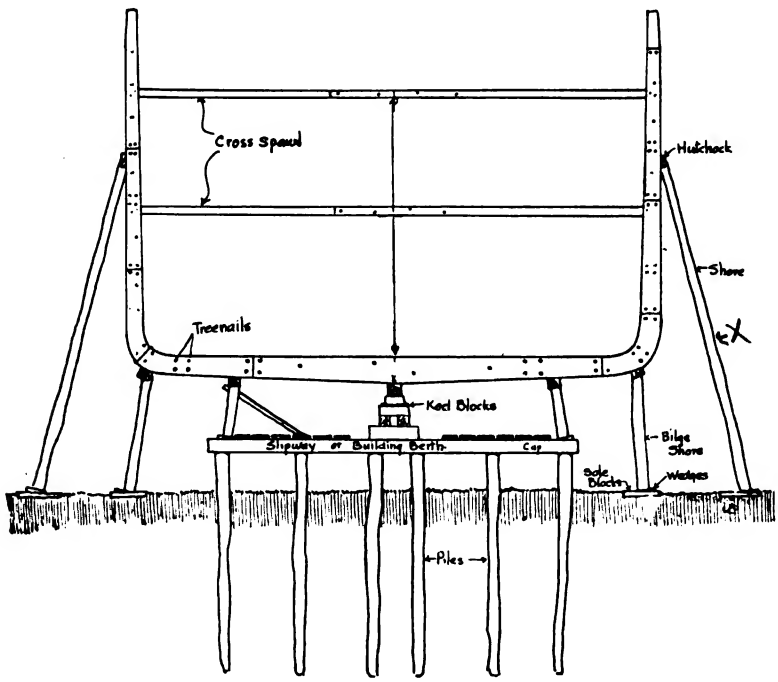

Fig. 27—A midship frame erected.

half way up on the after face. On the other frames the hutchocks are placed on the outer face only. The shores are placed in position by securing a tackle on each side of the frame directly over the desired position of the shore and securing the other end of the tackle to the shore and then hoisting the shore into position. About the top of the first frame is fastened a strong wire or manila guy rope long enough to lead well out ahead and behind so as to steady and brace the frame when in position. After the frame is erected it is sighted square to the keel with a big square about 12 feet long made of boards. The guy ropes are then tightened with *turnbuckles* or the tackles are set up to hold the frame steadily in place. The other frames are then squared across the keel, using the big wooden square.

The horning method of squaring the frames across the keel is sometimes used. This consists of measuring from a central point about 10 or 12 feet ahead of the frame to a point on each side of the frame, say at the first futtock head. When these distances are equal the frame is square across the keel.

The frame is plumbed athwartship by hanging a plumb-bob from the center of the cross spall and wedging up the shores on either side until the plumb-bob hits exactly on the center line on the keel. On the ground under each shore is placed a short, wide piece of 3- or 4-inch plank called a *sole block*. Wedges are placed between this block and the shore so that it may be wedged up tight.

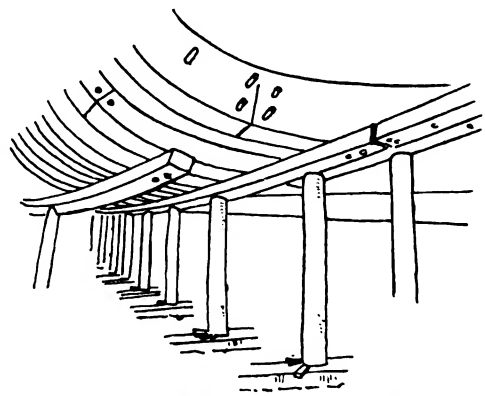

Fig. 28—Bilge shores supporting ship's frames.

If the keel is built on a slope of say ¾-inch to the foot, the frame will tip back at the corresponding angle. An *angle board* is sometimes used to indicate whether the frames have the proper amount of slant. This is simply a board with a plumb-line hung at one end and the ¾-inch to a foot angle laid off on it, so that when the plumb-line is parallel to this mark the edge of the board will show the *rake* or backward *tilt* at which the frame should be set.

After the first frame has been steadied by wire guys and braced securely in both directions by shores, the floor frame and keel are bored and a large diameter iron blunt bolt is driven through each floor frame to within a few inches of the bottom of the keel.

The other frames are erected in a similar manner. In order to seat the frames quickly and accurately at the proper distance apart on the keel, a block of wood of the same length as the distance between the frames, called a separator, is placed next to the last frame on the keel. Near the top of each side of the frame a *spacing cleat* of the same length as the distance between the centers of the two frames is loosely spiked to the outside of the frame.

The ship's frames are all numbered beginning at the extreme after end. In the 3500-ton D. W. C. Ferris-type ship, frames 1 to 6 are cant frames. Each frame, from 7 to 32, is larger than the preceding one, the difference in size and shape gradually growing less and less until between frames 29 and 32 the difference is hardly perceptible. The same is true at the bow from frames 83 to 60. Frames 32 to 60 are exactly alike in shape and size except that the upper ends of frames 32 to 54 are carried up higher than the others to form the *bridge deck*. Frames 8 to 1, at the stern, are carried up higher to form the *poop deck* and frames 79 to 83, at the bow, are carried up higher to form the *forecastle head* or *forecastle deck*. In all of these frames (32 to 54, 8 to 1, and 79 to 83), both pieces forming the frames are carried up to the full height. The lower or well portions of the ship, above the upper or main deck between these three raised structures, have only one piece

forming the frame, or *timber head,* as it is called, carried up above the deck line. These timber heads are known as *stanchions* and are the posts for the low fence-like structure called *bulwarks* which keep the ship's equipment or deck load from sliding off the decks into the sea in rough weather or when a heavy sea washes across the decks.

THE STEM

The big timber of wood at the forward end of the ship, called the *stem* or forward perpendicular (F. P.), is shaped and then notched or *rabbetted* to receive the ends of the planking. Two other pieces called the *stemson* and the *apron* are clinch-bolted up back of the stem to make it stronger, and pieces on either side called *knightheads* are clinch-bolted to the stemson and tapered off so that the outside ends of the planking may lie flat against it and thus give a larger surface to support, and to which to fasten the ends of the planking.

The corner formed by the stem and the front end of the keel is reinforced on the outside by an oak *gripe piece* and on the inside by a large knee or natural crook. These pieces are held firmly together by metal through fastenings or iron bolts clinch-riveted.

The stem is braced on either side and ahead by shores which are so adjusted that it stands plumb athwartship and with the proper amount of forward *rake,* as anything not perfectly vertical fore and aft is called.

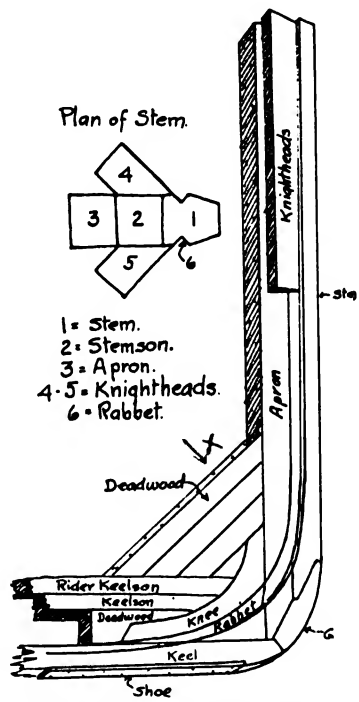

Fig. 29—Stem construction.

ERECTING CANT FRAMES

Cant frames differ from square or bevel frames in that instead of being set square across the ship's keel they are set at acute angles to the keel line and are more nearly square to the outer shape of the ship near the bow or stern. This reduces the acute angle to which they would otherwise have to be bevelled where they are secured to the planking.

The cant frames from frame 83 forward to the stem are held in position, when first erected, by curved strips of wood called *harpins.* The harpins are sawed out of timber to the shape laid out from molds taken from the ship's lines drawn on the mold loft floor, and show the form that the hull of the ship should take at the cant frames. After the cant frames have been assembled on the ground they are hoisted and placed inside these harpin ribbands with their lower ends or *heels* resting flat against the deadwood, with one small piece fitted into a notch cut in the deadwood to receive and steady it. This is known as *boxing in* the heels of the cant frames.

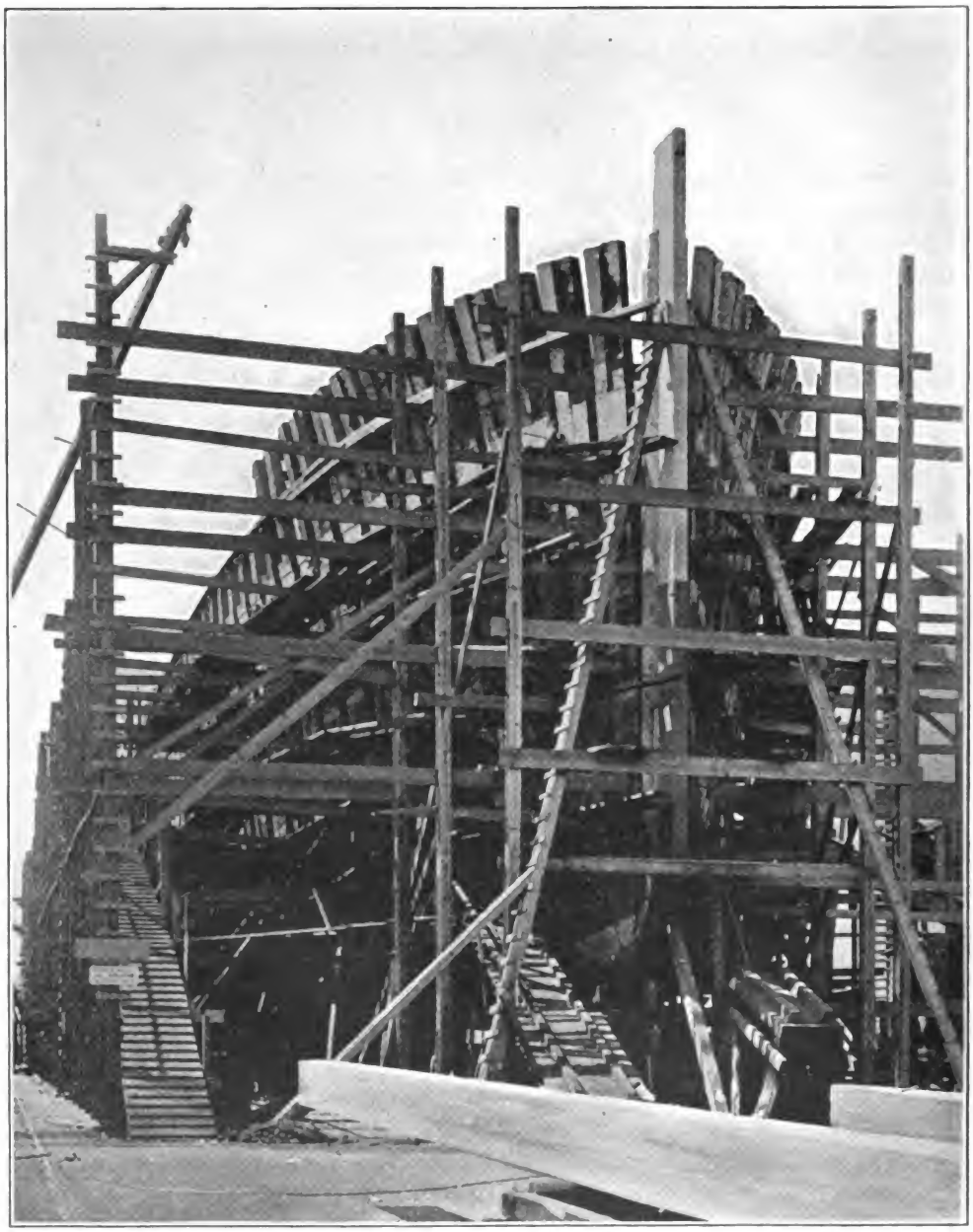

Fig. 30—Bow ready for planking, showing stem, knightheads, upper ribband, ramp, and method of supporting stem during construction.

HALF FRAMES

Half frames are similar to cant frames, in that they do not cross the keel but rest against the side of the deadwood. The difference between the two lies in the fact that the half frames are set at right angles to the keel, whereas the cant frames are set at acute angles to the keel. The lower ends of the half frames, like the cant frames, are notched into the deadwood and are held to it by *through clinch bolts.* The width of the hull across the top of the half frames is governed by a harpin mold.

THE PROPELLER

A steamship is driven through the water by her engines' turning a shaft that extends aft out through the stern of the vessel into the water with a large wheel or *propeller* at its extreme end. This propeller has two, three, or four large wide palms or blades bolted or cast solid on a hub or *boss.* These blades are set at such an angle that when they revolve, like an electric fan, they push on the water and so force the ship ahead.

THE STERN

There is a large upright oak timber at the after end of the ship called the stern-post, corresponding to the stem at the forward end. Where the shaft passes through the stern-post, the hole is so large that a considerable amount of timber is cut away. In order to strengthen this piece the stern-post is shaped so that there is a boss or apparent swelling in the post at the shaft hole. If timber cannot be obtained large enough to make the stern-post in one piece, it may be *built up* using two, three, or four pieces bolted together, and the *shaft log* (as that part of the deadwood which is directly forward of the stern-post and through which the shaft passes, is called) may also be built up of two or more pieces. A piece of soft white pine, called a *stop-water,* is fitted where the two or more pieces of the stern-post come

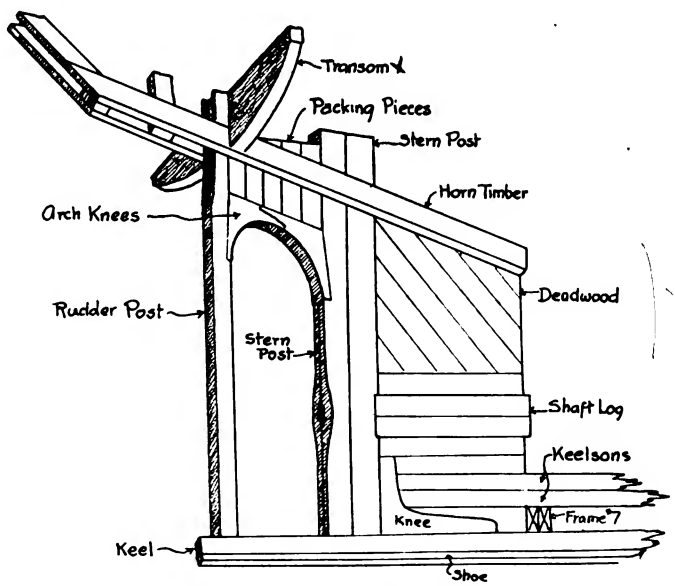

Fig. 31—Stern construction.

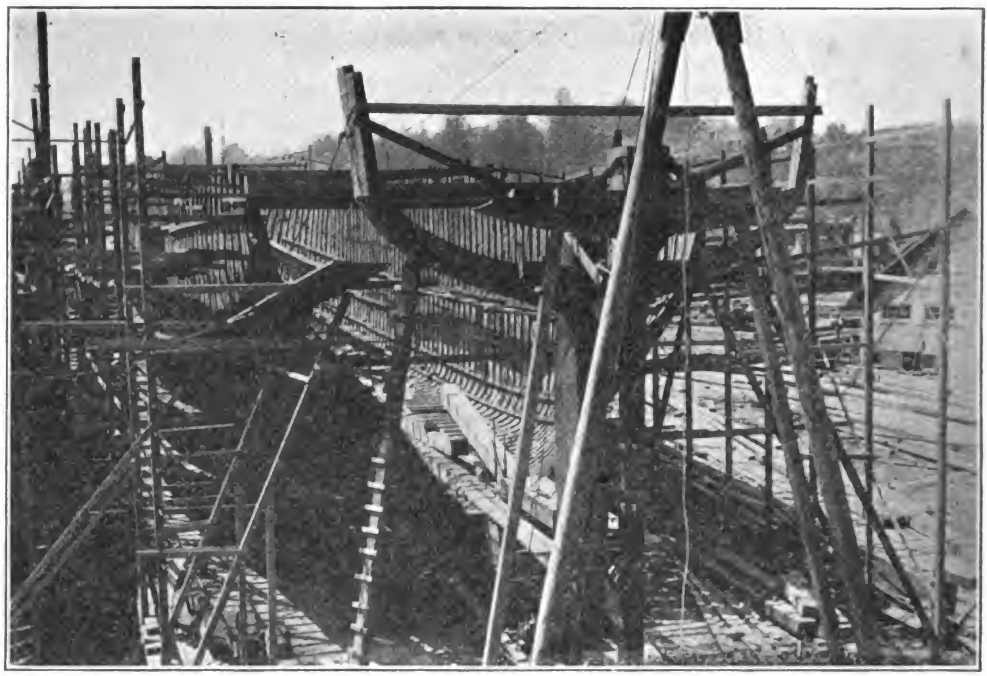

Fig. 32—Hull looking forward showing stern-post, stern-frame, rudder-post, gudgeons, shaft-log, and method of supporting stern-frame during construction.

Fig. 33—Shaft log and after deadwood, showing stopwaters in shaft log.

together to prevent water from leaking through. This method of making the hull water-tight is used in many other locations in the hull, such as in a built-up shaft log or where the water-tight bulkheads join the ship's sides and framing, particularly where joints cannot be calked water-tight.

In the rear of the stern-post, far enough to allow the propeller to revolve freely, another vertical oak post called the *rudder-post* is fitted parallel to the stern-post and secured to it at the top by knees forming an arch. Above the *arch knees* between the two posts, more deadwood, called *packing pieces,* are fitted and all securely fastened and clinch-bolted together.

The lower ends of both the stern-posts and rudder-posts have wide tenons cut on their ends which fit into mortises cut into the top of the keel. These mortises are cut deep enough to allow treenails to be driven horizontally through both keel and tenon. What really hold the posts and the keel together, however, are large iron or steel knees at the angle formed by the keel and the stern and rudder-post, and large plates fitted on the sides of the keel with arms extending up each side of the posts. All this work is clinch-riveted in position. The upper part of the arch over the propeller is also shod with iron bent so as to fit against the under face of the two knees forming the arch and extending down far enough to bolt to the stern-post and rudder-post, thus tying stern-post, keel, rudder-post, and deadwood securely together.

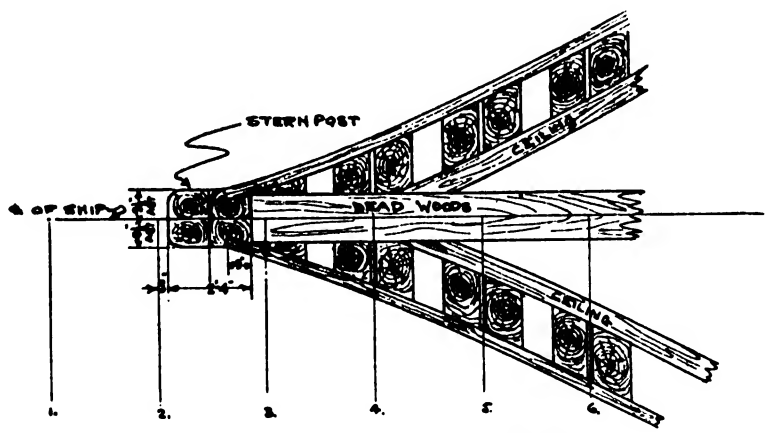

Fig. 34—Sectional plan view of stern showing planking rabbeted into stern-post and deadwood; also cant frames and ceiling.

Two big *horn timbers* form the backbone of the overhanging portion of the stern and are clinch-bolted through the deadwood to the stern-post and rudder-post. The stern-post and other sections of the stern frame may be raised into position with a traveling crane or with single derricks or gin poles and tackles. The transom, built up of solid logs in the same manner as the back end of a rowboat, is placed on top of the horn timbers against the rudder-post. Then by setting up as a guide, ribbands or sticks of wood cut to the round of the stern and called the after harpins, the small timbers or *fan tail* that spread out like a fan and shape the stern, can all be fitted into their proper locations and their lower ends bolted to the transom.

THE RUDDER

At the same time the *rudder* can be shaped and put together on the ground near the stern of the ship. Straps with pins called *pintle straps* are riveted to the forward edge of the rudder and straps with holes, called *gudgeon straps,* are riveted to the rudder-post. The rudder is hoisted so that its top goes in between the horn

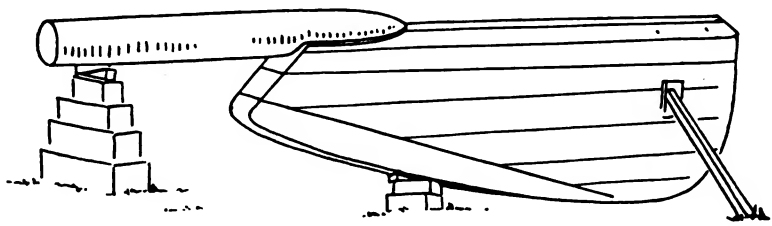

Fig. 35—A rudder.

timbers which are blocked off, forming a water-tight box or trunk, and then lowered so that the pintles drop down into the gudgeons or permanent supports of the rudder. The pintles and gudgeons form hinges on which the rudder swings from side to side.

The rudder-post is usually raised and set in place first and the rudder hung later, but some shipyards assemble the rudder-post on the ground and raise the whole combination at one time.

LINING UP THE FRAMES

The frames of a ship after erection, with their multitude of shores, present an interesting sight and show the ship's form very distinctly. The next step is to regulate and pull the frames into line. This is usually done from a scaffolding erected around the outside of the hull. The uprights for this scaffolding are built of small light fir or spruce poles of sufficient length so that workmen can work on the hull planking or the rails at the top or ends of the frames. Adjustable scaffolding uprights are easily made, using two 3 x 8-inch planks bolted together with separator blocks spacing the two planks about 3½ inches apart. Holes are bored about 12 inches apart staggered through both planks and ¾ x 12-inch bolts are used as rests to support the thwarts or beams which carry the scaffolding planks. Uprights are placed in pairs—one near the side of the hull and one about 5 feet from it. Each pair of uprights is spaced from 8 to 10 feet apart along the side of the hull. This spacing allows the use of 3 x 12-inch scaffolding planks 12 to 14 feet long. Great care should be taken to see that the scaffolding is well braced, especially with diagonals, and secured to the hull framing or planking at intervals with blocks or cleats, if possible, so as to make a rigid structure.

A ship with its curved sides requires more scaffolding than a house with its vertical walls because various lengths of uprights must be used to reach in under the counter or flaring sides of the ship. The scaffolding is usually erected as fast as the frames are set up so that another gang of men can put on the *ribbands* or long lengths of 6 x 8-inch spruce or yellow pine, which hold the frames rigid and in line. After the ribbands have been placed across each frame holes are bored and ¾ x 12-inch lagscrews with plate washers under their heads are put in. As the

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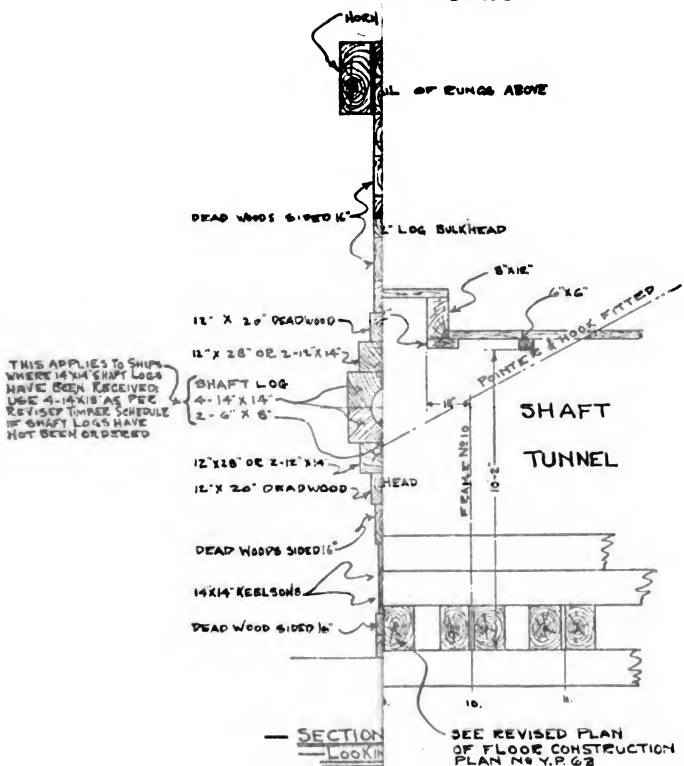


Fig. 37—Frames set up, but no scaffolding erected.

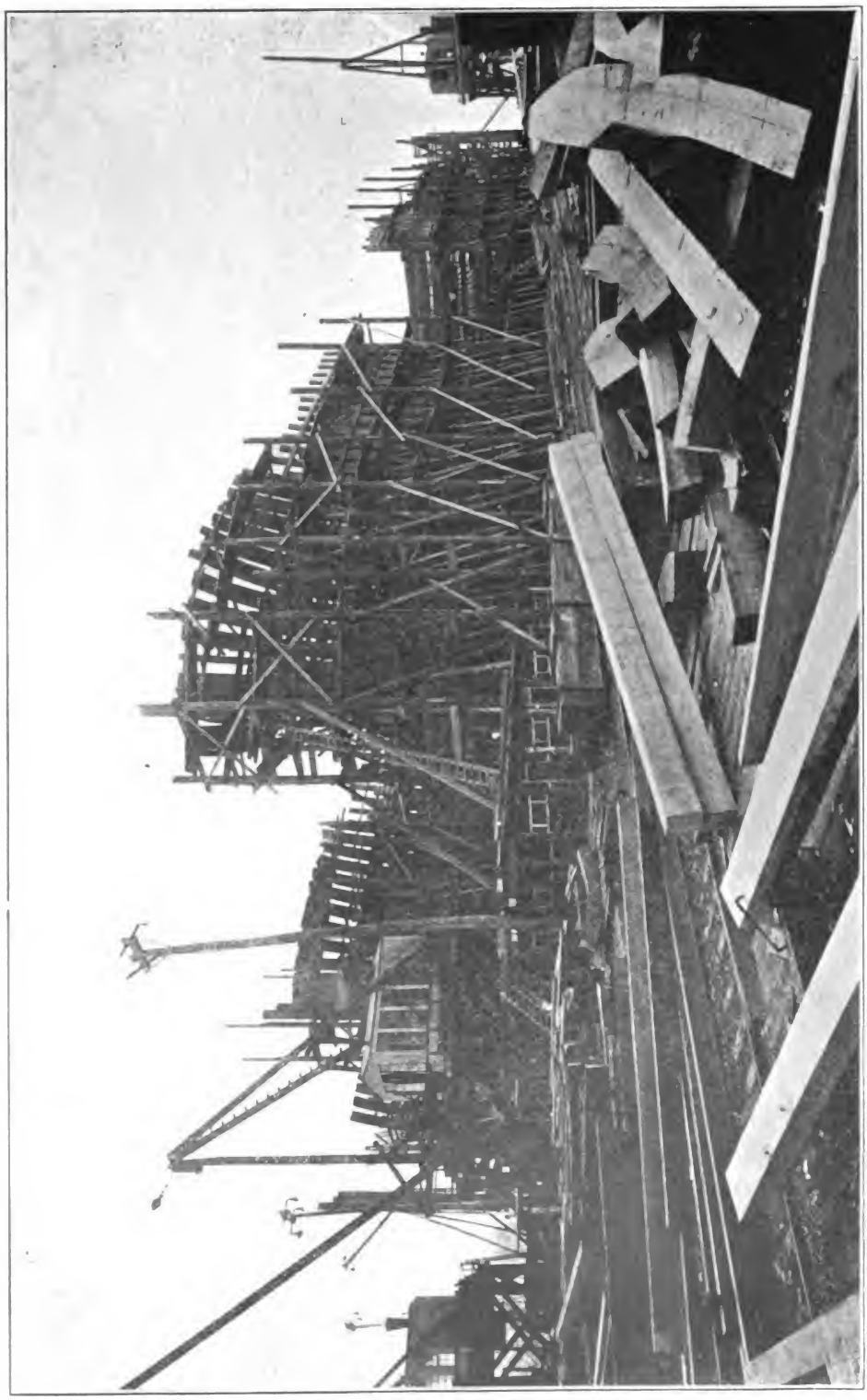


Fig. 38—Hull in frame. Scaffolding partly erected. Some of the frames have been left out of the middle section to allow the bottom ceiling and keelsons to be passed into the hull easily.

lagscrews are tightened with wrenches the ribbands pull the frames into a fair line so as to be ready for the planking. When the edge of a frame sticks out so that the ribband can not run in a fair curve the frame is dressed smooth or *dubbed off* until it is fair. Dubbing is a hand operation which is very expensive and should be avoided wherever possible. The work is done with an adz—a hand cutting tool having its blade at right angles with its handle and used with a sweeping blow. The men engaged in smoothing off the unevenness of the frames, inside and out, are called *dubbers;* those who do the first line of dubbing to show how much shall be cut off are called *liners.*

In the construction of the hull, where the shape is the same for a considerable distance along in the middle section, any unevenness in the framing may be corrected by bolting wooden ribbands to the under side of the floor frame about half way out from the keel. Shores are erected under these ribbands and wedged up until any unevenness is corrected.

Where the lay out of the shipyard will permit and there is room enough on each side of the hull and when several vessels are to be built of the same width, the scaffolding around the bow and along the straight sides of the vessel can be permanently erected. This can be done by setting the scaffolding posts firmly into the ground, care being taken temporarily to brace the scaffolding when not attached to the ship's hull. Where clear space is very narrow on each side of the hull under erection single scaffolding poles or frames can be erected. These can be made permanent by securely imbedding the lower end into the ground and bracing temporarily during the launching operations or in cases where the scaffolding was not secured to the hull. When the hull is under construction and the frames are up the scaffolding can be easily braced by attaching thwarts to the hutchocks.

THE KEELSON

After the frames, stem, and stern have been erected the hull is ready to be ceiled on the inside and planked on the outside. The outside of the hull must be as smooth as possible so that the ship may slide through the water with the least possible friction. For this reason all of the timbers, shelves, waterways, girders, or keelsons used to stiffen the hull structure are built inside the hull planking and frame. The keelsons are the first of these strengthening timbers to go into the ship. In the Ferris type of hull there are eight keelsons each one of which is made up from long 14 x 14-inch timbers scarfed together in the same manner as the keel. Five of these keelsons are laid side by side on the floor frames after they have been dubbed fair and smooth so that a straight edge lies evenly upon them and three keelsons are put on top of the first five, making the total depth of the keelson 28 inches. The keelson timbers are first clamped in place and are then fastened or clinch-bolted together horizontally as well as vertically. The process of boring holes and driving bolts through all of this solid wood has been rendered comparatively easy by the use of the air drill and air hammer.

CEILING CONSTRUCTION

On the inside of the frames the hull is planked with thick boards heavy enough to withstand the banging of the cargo. This construction also materially stiffens the hull. From the keelsons out to the bilge where the hull rounds up into the vertical sides the *floor ceiling,* as the inside planking is called, is laid and held

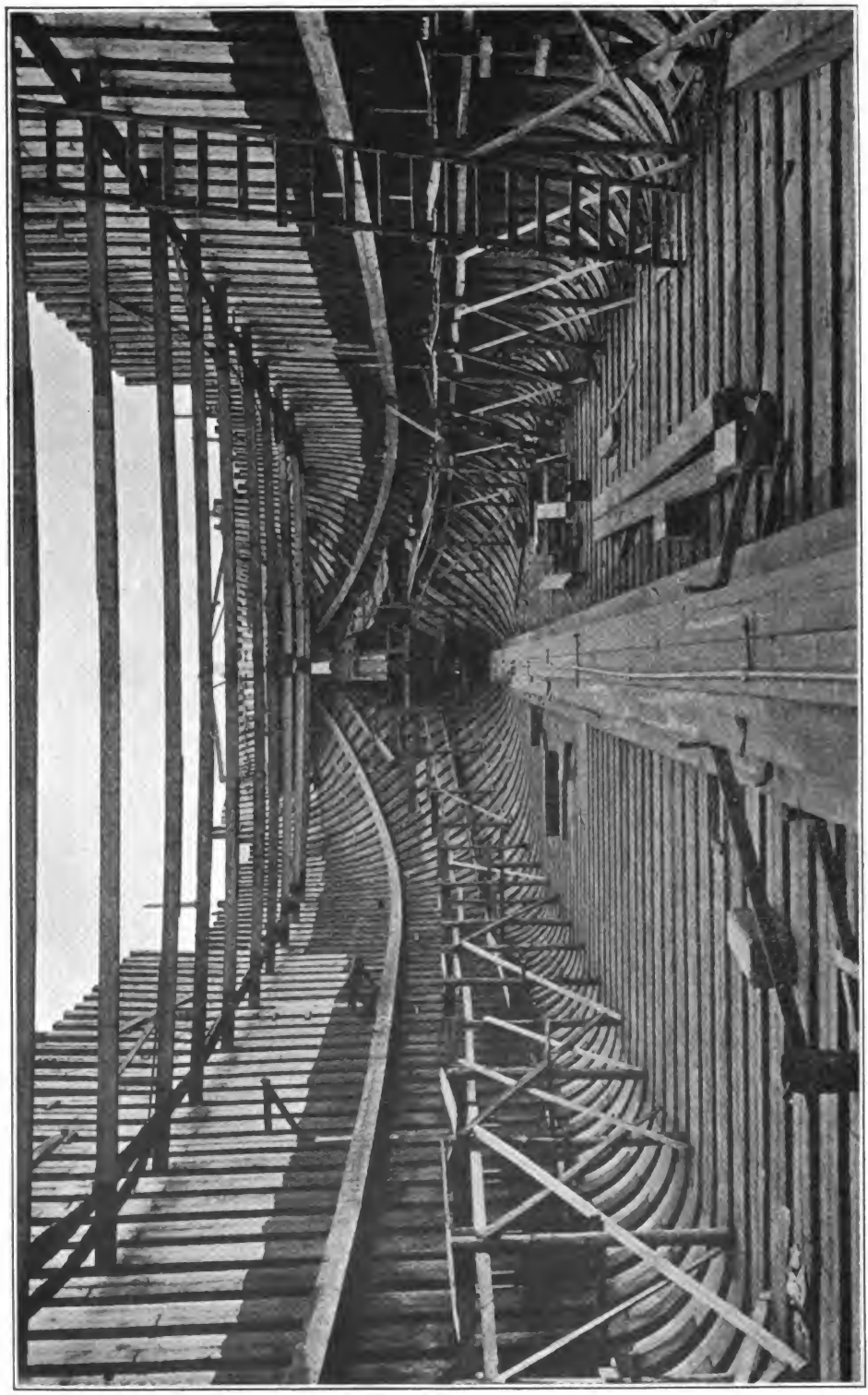


Fig. 39—Interior of hull looking aft showing keelson construction, ribbands, and cross spalls.

in place by iron bolts about 24 inches long driven down into the frames. Only one bolt is driven in each frame until after the outside planking is put on and fastened. This is done to avoid hitting the iron bolts with the augers when boring for the fastenings to hold the outside planking. If the inside vertical surface of the frames is not fair, the frames must be dubbed off to a good bearing surface for the ceiling planking. This work is done with adzes where the futtocks are not fair by men who work from a temporary scaffolding built around the sides of the vessel. One plank of the floor ceiling next to the keelson is left out and in its place a loose plank is fitted, called the *limber strake.* Each line or row of planks put on the hull, either inside ceiling or outside planking, is called a *strake.* The loose limber strake enables one to get at the space between the ceiling and outside planking to clean out the gutter or *limber* which is cut in the under side of the frames or grooved out of one of the thick bottom bilge planks. The limber carries off any water which may leak or collect in the ship's bilges to suction pipes connected with bilge pumps provided to suck it up and discharge it overboard. To prevent this *bilge water,* as any water that leaks in is called, from slopping up through the inner skin or planking and damaging the cargo and also to stiffen the hull, each seam of the floor ceiling is either calked with oakum and filled with hot pitch or is made tight by driving wedges between each two strakes of ceiling.

To open the seams so the pine ceiling wedges may be entered an iron wedge, fitted with a loose handle called a reaming iron, is held on the seam by one man while another hits the wedge with a large wooden mallet called a *beetle.* Ceiling wedges are all the same angle or thickness but are made in two distinct shapes. One being wider across the bottom is called a *female wedge,* and the other being wider across the top is called a *male wedge.* Two female wedges are inserted in the seam with space between for the male wedge. The widening edges of the male wedge when driven engage the tapering edges of the female wedges and join them all tightly together endwise and make the seam water-tight. The mashed tops of all these wedges are then trimmed off even with the ceiling with an adz or chisel.

The work of putting in the ceiling in the middle of the ship is simple, as it is all *square work,* so called to distinguish it from *bevel work* or fitted work, which is required at the narrow, fine, or pointed ends of the ship. All of the ceiling planks diminish in thickness and width at the ends. Thus a ceiling strake 8 inches thick and 12 inches wide may be reduced to 6 inches in thickness at the tip end, while the width tapers down on some planks almost to a point, on others to 5 or 6 inches. The end pieces of the strakes of ceiling are called the *hood ends.*

This reduction in thickness permits a considerable part of the necessary twist to be cut in the plank. The rest of the twist is obtained by putting the plank into a steam box, where for a couple of hours live steam is turned on for the purpose of softening the fibre of the wood so that it

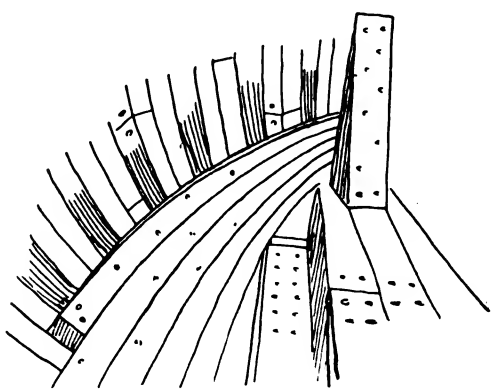


Fig. 40—Interior of hull looking forward showing ceiling, keelson, rider keelson and deadwood in the bow.

Fig. 41—Interior of hull at stern showing ceiling, deadwood, counter timbers, shaft log, stern framing, after harpins, cross spauls and temporary staging for erecting and fastening ceiling.

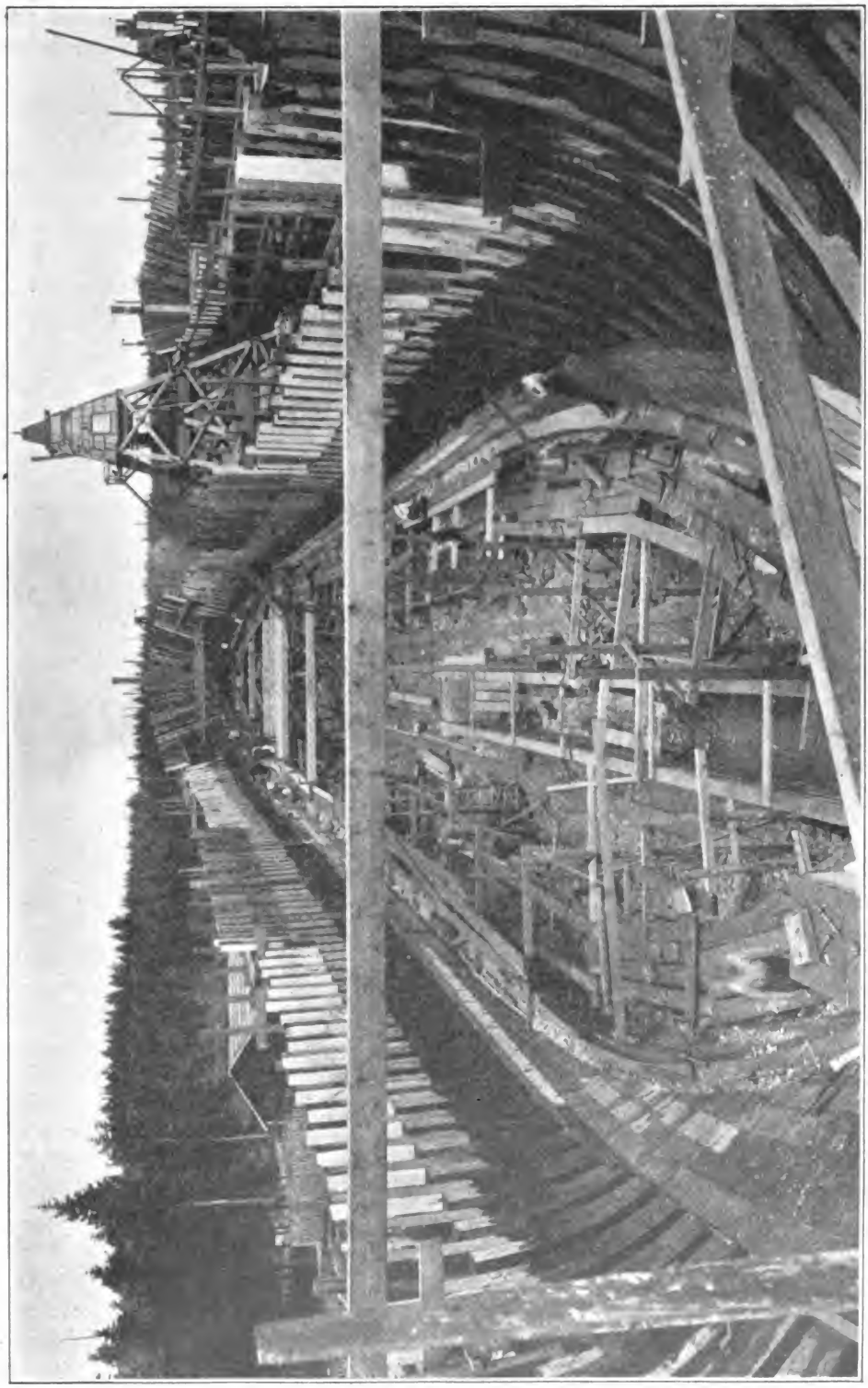


Fig. 42—Interior of hull looking forward showing floor ceiling, bilge ceiling, sides of shaft tunnel, and forward lower hold beams.

may be twisted or wrung around. This hot plank is pulled down against the frames by large iron *screw clamps,* or *grasshopper clamps,* which are attached to the frames. The hot plank is forced sideways tightly up against the adjoining plank by *jack screws* butted against short iron pegs called *dollies* which are set in holes bored in the frames.

The shape or taper that each plank is to be cut to is obtained by tacking on the frame a batten or thin strip of wood, 2 to 3 inches wide and ¼ inch thick, and marking at intervals on the frames with a race knife and on the batten with chalk the widths measured from this line that will make a fair curve for a new plank. By laying this batten on the timber from which the new plank is to be cut and measuring off these widths, a line can be run showing how this new plank is to be sawed.

The bilge or corners where the bottom and sides meet are the weakest parts of the ship's hull and are strengthened by eight rows of strakes of 14-inch bilge ceiling worked in, the same way as in the thinner floor ceiling.

If all the edges of the ceiling planks were left square when placed one beside the other around on the hollow curved shape of the hull at the corner or bilge, it is evident that only their upper edges would touch. Therefore, the edges must be bevelled before the plank is bent in. The angle of bevel to be cut on each plank is obtained by using a bevel square and measuring the angle between the frame and the edge the plank is to fit against. If, say, 20 feet from the bow the edge is square, mark a zero at that point on the plank; then at 15 feet if it shows 2 degrees of bevel, mark a "2" at that point. The sawyer will then start his band-saw at zero at the 20-foot mark, turn to 2 degrees by the time it has cut into the 15-foot mark, and so on, increasing or decreasing the angle according to the degree of bevel that has been marked on the plank.

Before the long, heavy timbers that run lengthwise of the ship under the deck beams and against the inside of the frame can be put in, battens must be tacked along the outside of the ship's frame at the saw cuts, put there when the frames were assembled. By sighting along this batten any unfairness can be remedied by shifting the batten up or down until it shows a fair, true curve.

When the upper deck and lower or tween deck lines are thus faired up, height marks are scribed on the sides of each frame, so that they can be seen from the inside or the outside of the ship. These height marks are usually cut on a line at the top of the deck beams. At the depth of the bottom of the deck beam below these marks, a line of heavy fore and aft timbers, called the *shelf,* is securely clinch-bolted to the inside surface of the frames. These timbers support the deck beams. Underneath the shelf is a single line of timbers called *clamps.* The shelf and clamp timbers are joined by scarfing and thus made continuous. The shelf and clamp timbers form a continuous girder along the inside of the ship, strengthening and stiffening the whole hull framing.

Putting in these timbers is a very difficult operation as it requires considerable force to bend a 14 x 14-inch yellow pine timber sideways around the curve of the bow and stern and upwards to meet the *sheer* of the ship, as the curve upwards from the middle towards the bow and stem is called. In order to bend these timbers sideways around the curve of the bow and stem, they are slit nearly their entire

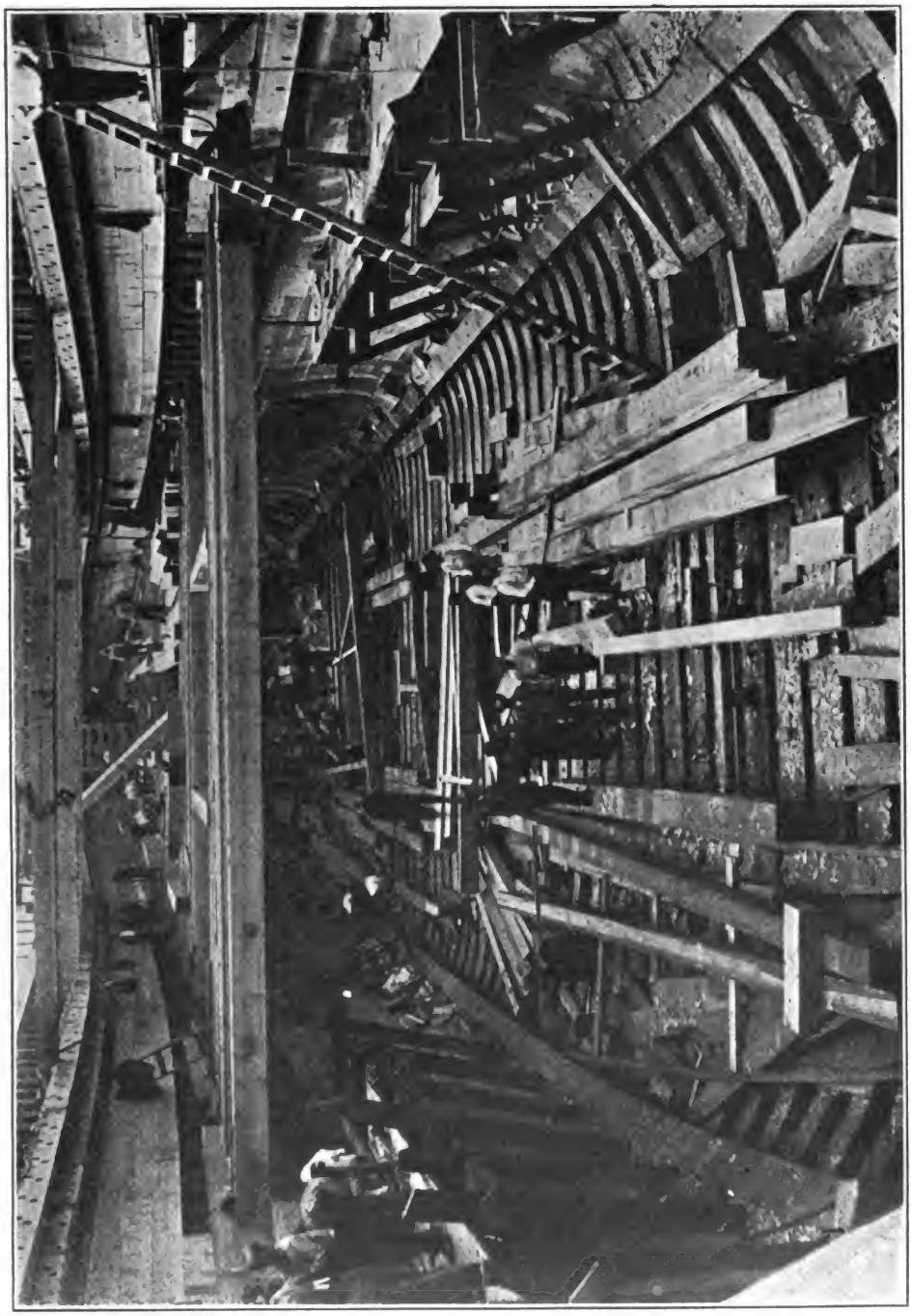


Fig. 43—Interior of hull looking forward, showing lower hold beams, shelves and shelf strake.

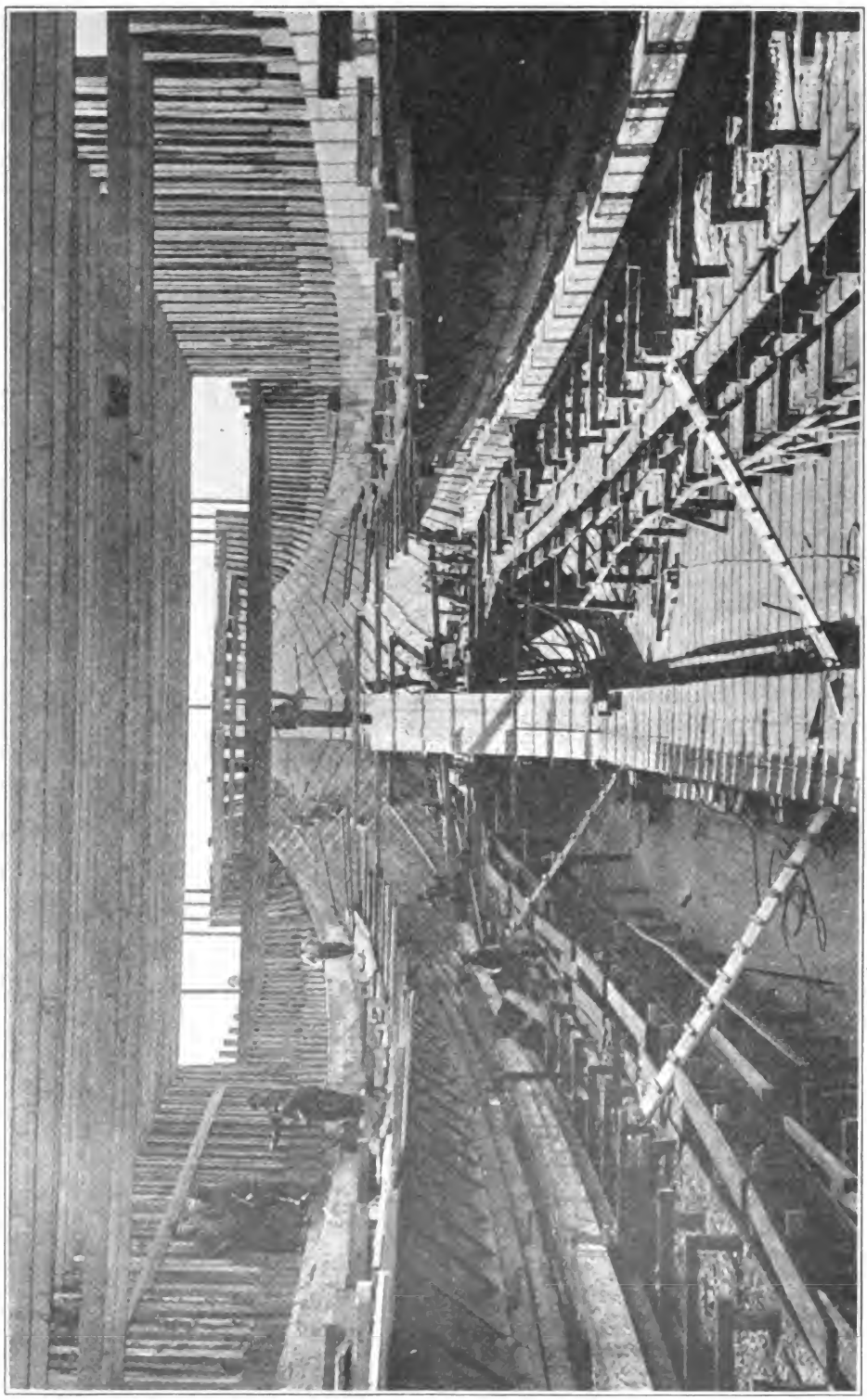


Fig. 44—Interior of hull looking forward showing the five lower keelsons, floor and side ceiling, lower shelves, shelf strake and temporary staging used by workmen to put on side ceiling.

length on a saw, and then softened by steaming and bent in while hot. The outer edge of the first piece of clamp must be bevelled so that the inner face stands plumb; then all the succeeding pieces will go in *square work,* as it is called. If the first piece is not bevelled in this manner but is put in so that its inner edge has the same flare as the frame, each succeeding piece will stand with one corner up and will have to be dubbed off and sprung edgeways, so as to keep the ends down to the proper height.

The work on these clamps and shelves is done from stage planks placed on the cross planks on the inside of the ship. The timbers are pulled out against the frames with chains, wedges, or screw clamps. Where the distance is too great for the reach a *ring staff* is used. This consists of a stout hickory pole about 4 or 5 inches in diameter and 6 or 8 feet long. The lower end of the pole is held by an iron ring fastened to a long bolt which is temporarily put through a hole bored through the frame secured with a nut and washer or key on the outside. The upper end of the pole is held by ropes. A powerful force can be exerted upon the timbers being bent by first pulling the ropes as tight as possible by hand and then placing a bar between the ropes and twisting them up. This is called a *Spanish windlass.*

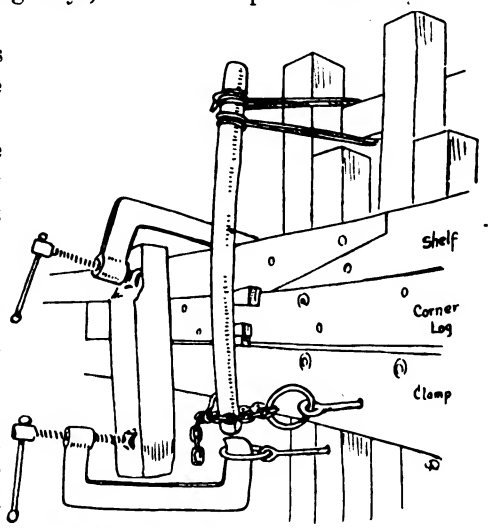


Fig. 45—Putting in clamps and shelves, showing how screw clamps and ring staff are used.

In addition to bending the shelves and clamps sideways it is necessary to curve them slightly up at each end in order to meet the *sheer* of the ship. The process of curving the timbers upward is called *edge setting* and is accomplished by the use of screw jacks, butted against dollies set in holes bored in the frames.

As soon as the shelf is in place the planks directly opposite it on the outside of the frames may be trimmed and fitted. These planks and shelves form a rigid ribband while the remainder of the planking is put on. Then the upper and lower deck beams which run across the hull are fitted in. Any house carpenter can fit these, as they are like floor beams. The lower tier is composed of perfectly straight timbers, but the upper tier is cut with a slight upward curve or *camber,* which is an arc of a circle with a very slight rise. The upper decks are always laid with a camber so that water will not lie in puddles upon the deck but will drain off to either side. Where the deck beams join the side of the ship, *bosom* or *lodge*

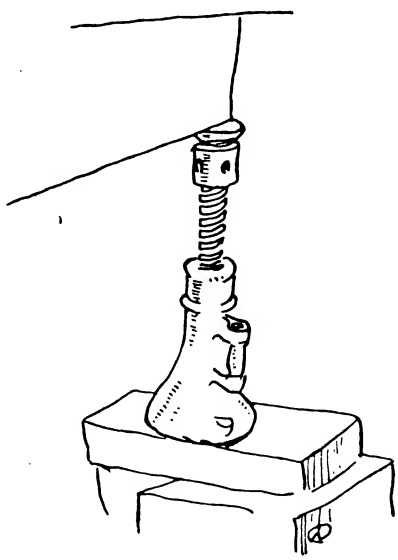


Fig. 46—Jack Screws.

knees are fitted horizontally to the forward and after sides of the beams and to the frame or ceiling. These knees help stiffen the ship's hull. The deck beams are located according to the plans so as to leave openings or *hatches* for the machinery and cargo to be lowered into the ship.

Beneath the deck beams under the sides of the hatch openings are placed fore and aft timbers called *girder timbers.* Supporting the *girder timbers* are *stanchions* or upright posts resting on similar end-to-end timbers called *girder keelsons,* built up on the ship's inner bottom or floor ceiling. These stanchions are cut long and the beams are jacked up so that they will have a slight curve or camber. Knees

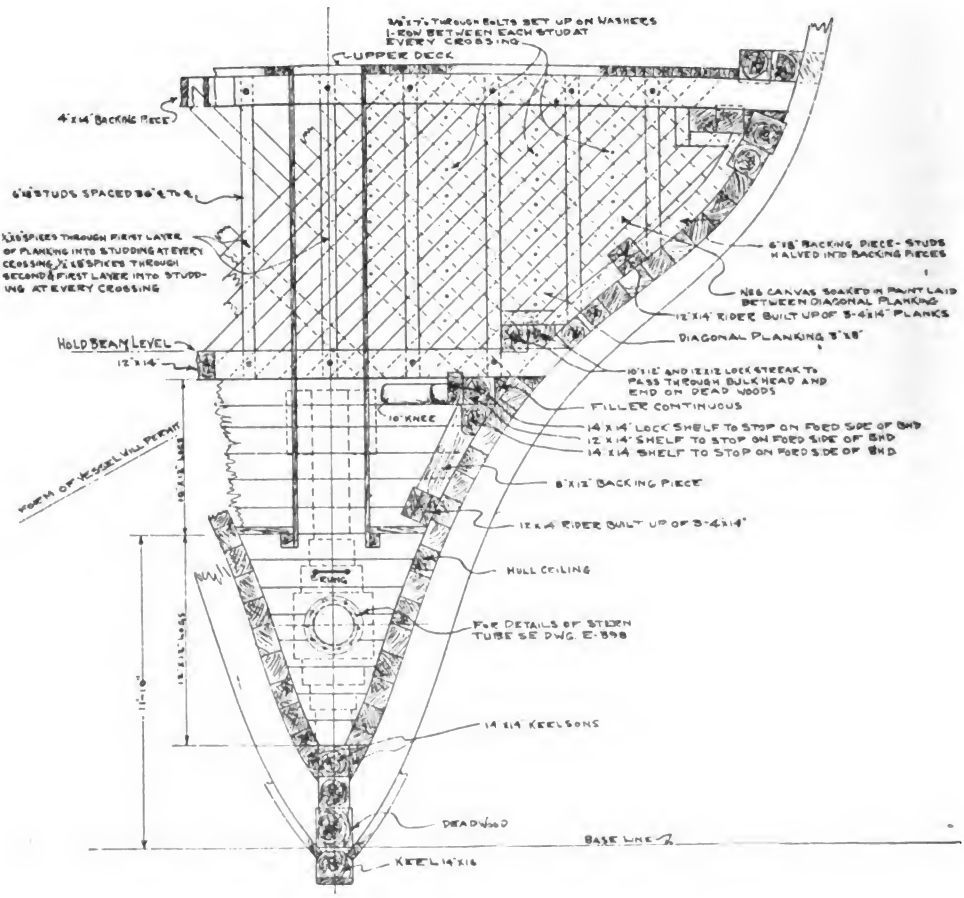


Fig. 47—After peak bulkhead at Frame 7.

are fitted vertically on these stanchions at the angles formed with the deck beams and girder keelsons, and are known as hanging knees.

Meanwhile the vertical sides of the ship should be ceiled in the same manner as the floor, except that where the planks in the floor ceiling are merely butted end to end, the planks in the side ceiling must be flat scarfed where they join and *edge bolted.*

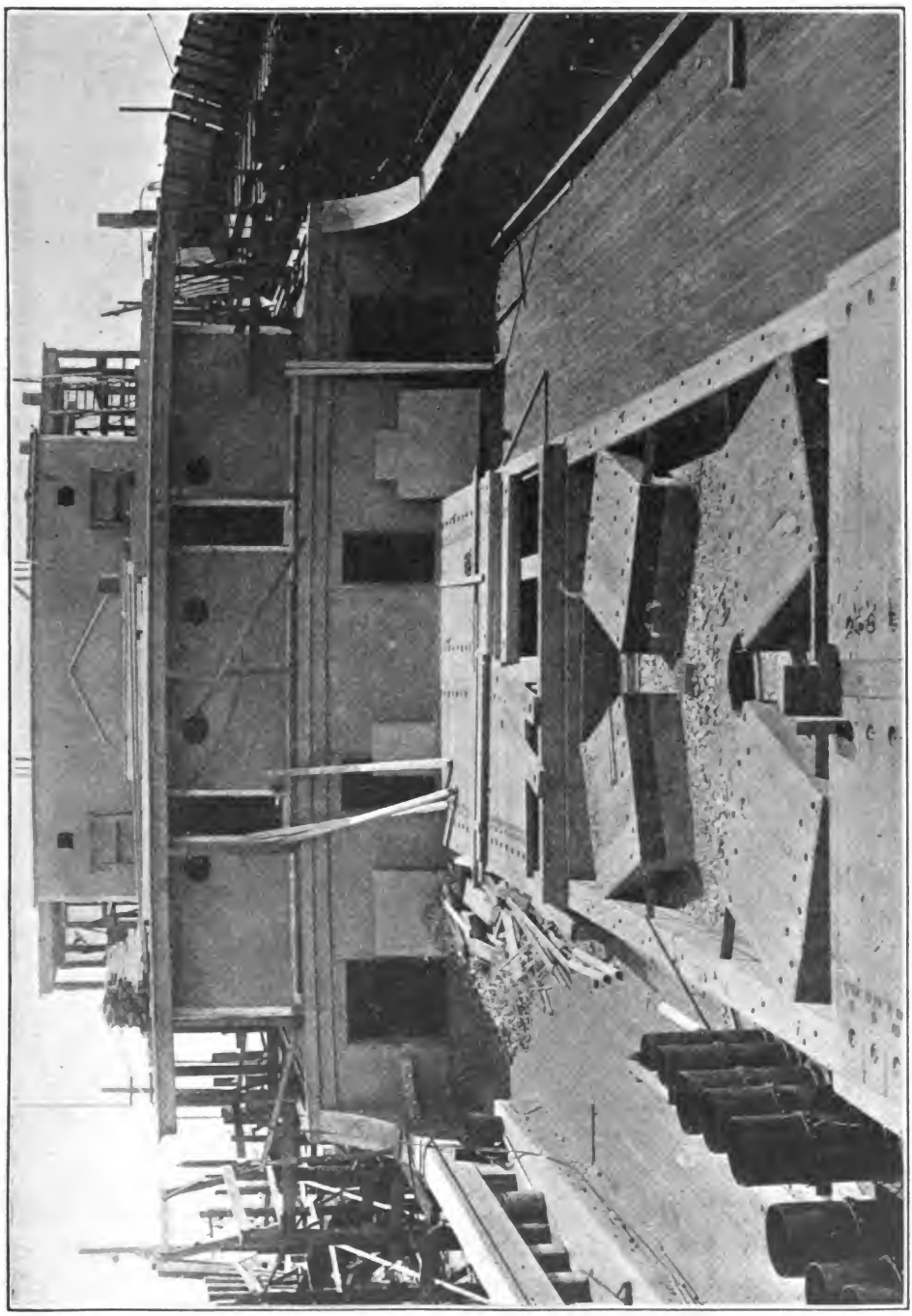


Fig. 48—Main or upper deck looking aft showing bridge, bridge deck house, boat deck house, bulwarks, hatch coamings and covers, hatchways, winch foundations and ventilator throats.

Above the deck beams are placed heavy fore and aft timbers similar to the shelves below them. The first line of timbers is placed against the inner face of the frames; the second is finished flush with the first but is two inches thicker. This extra thickness is let down into a score cut out across the ends of the deck beams to receive it and is for this reason called the *lock strake*. These timbers are called *waterways* or *planksheer*.

Several partitions, known as *bulkheads*, must be built across the inside of the hull dividing it into water-tight compartments. Diagonal and horizontal bracings of wood called *riders* and *pointers* are fitted against the ceiling forward and aft to stiffen the forward end, stem and bow, and the after end, stern-post, shaft log, and stern, where the vibrations of the propeller are sometimes very severe.

The laying of the decks and the building of the deck houses is work which any house carpenter can soon pick up, as there are but few details which are different from house work, except that this framing calls for a very high grade of skill. The deck planks are first clamped and wedged into place. They are then spiked, the spike heads are countersunk, and the holes are filled with soft white-pine plugs set in white lead. After the spike heads are plugged the seams are calked with oakum and filled with a pitch composition to make them water-tight.

There are many other small details all of which are comparatively simple, such as the fitting of chocks between the floor timbers to prevent the bilge water swashing from side to side and filling blocks between certain frames where the pipe lines of the ship run and where the windows or *port lights* are set.

In fact, there is nothing about wooden shipbuilding that any man with a knowledge of tools and a willingness to work and learn cannot do. Many of the best workmen in the shipyards today are young men who never saw a ship under construction before, but who were quick to learn and pick up new ideas. What is most needed is competent instructors; men who can show others what to do.

STEEL STRAPPING

The entire outside of the ship's frame, wherever the lines are not fair and the planking would not bed properly, is dubbed off with an adz to receive the planking in the same manner as the frames on the inside were dubbed for the ceiling. After this has been done, a network of diagonal steel or iron strapping with a top horizontal belt course is put on for the purpose of adding to the stiffness of the ship. This strapping is fitted in grooves or *daps* cut in the outside face of the frames so that the planking can fit flat against the frames over the strapping. The strapping is riveted at all intersections and also to the belt course, and is secured at each frame with iron or steel drift bolts.

PLANKING CONSTRUCTION

Next to the frames, the exterior planking probably is the most important part of the ship's structure. The ceiling is more difficult to install and is therefore put on first so that the clamps, used to pull the ceiling tight against the frames, can be hooked to the outside of the frame.

Planking a ship is a trade in itself. The planks should be so tapered that the same or nearly the same number of strakes of planking that go around the broad

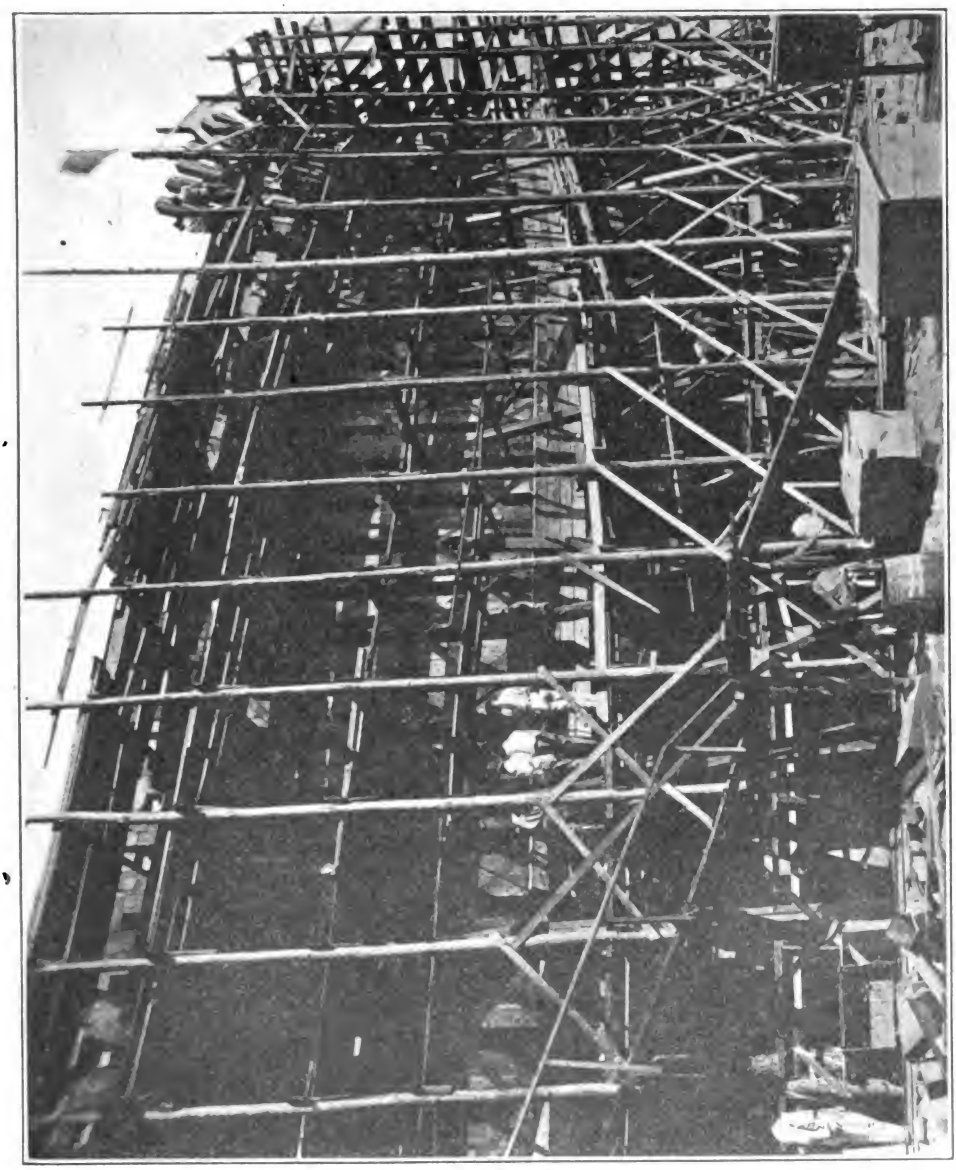


Fig. 49—Ship planked just above the water line showing the frames of the upper part and the steel strapping used for reinforcement.

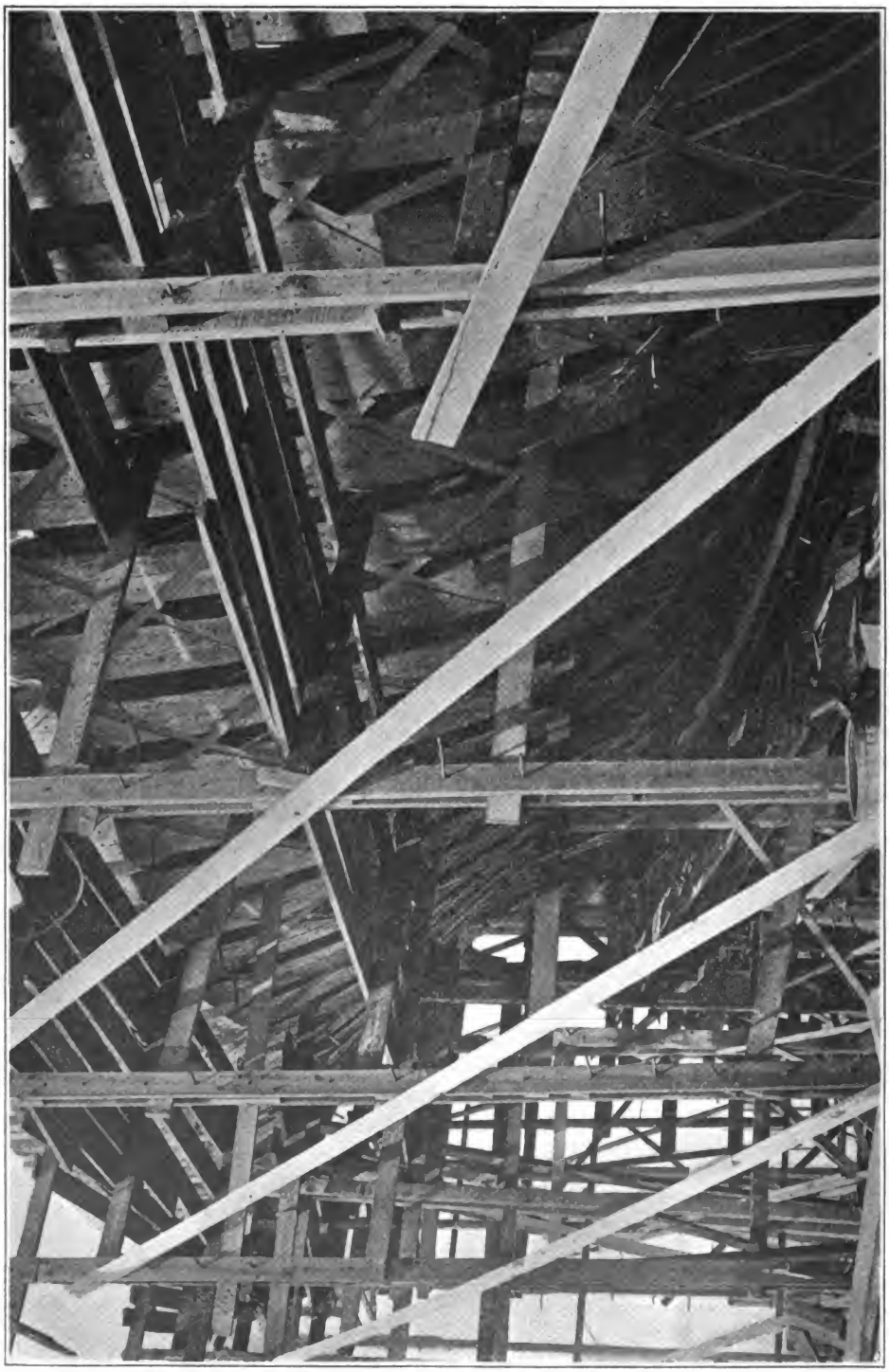


Fig. 50—Stern showing steel strapping, planking, holes bored in frames for ceiling fastenings, and staff rings set in planking and frames.

middle portion of the ship will show at the hood ends where they terminate at the stem and stern-post, and the edges must all run in symmetrical lines. When the strakes are not continuous from bow to stern, that is when there are more strakes amidship than at the stem and stern-post, *stealers* must be used to close in the ends of the strakes which are not continuous. This is a very poor method of planking. The edges of the planking must fit as near perfectly as possible, tight on the inner edges with a narrow V-shaped opening between the outer edges, so that the seams may be calked with oakum and made water-tight. The laying out of the lines or strakes on the frame is called *rasing* and is usually done under the supervision of the loftsman.

Planking is put on the outside of the frames in very much the same manner as was the ceiling on the inside. After being lifted into place the bottom planks are tightened into position by chains, screw jacks, shores, and wedges. The plank is first tacked on with 10-inch galvanized boat spikes driven by hand. Holes are then bored entirely through the planking, frames, and ceiling, into which treenails are driven. When the treenails are sawed off flush with the planking and ceiling, both inboard and outboard ends are split with chisels and narrow hardwood wedges are driven in so as to expand the treenail and jam it tightly into the wood so that it cannot work loose and the planking cannot spring off.

The first strake of plank next to the keel is called the *garboard strake,* and in the Ferris type ship is 10 inches thick. This is edge-bolted through the keel to the opposite garboard. The next strake of planking is the *first broad strake* and is 8 inches thick. The next is the *second broad strake* and is 6 inches thick. The rest of the bottom planking out to the bilge is 5 inches thick. Around the bilge 6-inch planks are used, being reduced again to 5 inches on the *topsides* until within about eight planks of the top where the *wales,* as the top planks are called, are 6 inches thick.

In most yards the ship is planked from the keel upward, but sometimes the garboard strakes and wales are first put on and the planking continued from both directions toward the bilges.

After the bottom has been planked sufficiently high around the turn of the bilge to permit its being calked, it should be flooded with water, commencing at the forward end so that the water will flow aft over the top of the frames and ceiling and wet all the fastenings. This should develop any incipient leaks which can be easily remedied at this stage of the work.

The leaks in metal fastenings can be stopped by driving the fastening in further and clinching up before inserting the soft wood plugs in the outside face of the planking. Treenails can be made tight by cross-wedging and seams marked for extra tension with a calker.

Wedges for treenails should be made 1/32 of an inch wider on the back or thick end than the hole into which the treenail is driven. If after water-testing the bottom treenails show weeping, they should be cross-wedged with additional wedges driven into the head of the treenail at right angles to the first wedge. This additional wedging should expand the treenails enough to make them water-tight. If they cannot be made water-tight at this time they should be backed out of the hole and replaced with new and slightly larger treenails.

Seams should not be payed or cemented, and plugs should not be inserted until after water-testing. Any leaks which develop in the deadwood can be stopped with soft pine stopwaters at this period of the construction. If leaks develop that cannot be stopped, as above described, or they should appear in inaccessible places, this trouble can be overcome by gunning the seam with a red lead and tallow mixture using 100 pounds of air pressure if necessary. This high air pressure forces the tallow mixture into all sorts of crevices, checks or seams. The method of gunning a suspected location of a leak is as follows: Bore in with a small bit or auger to the suspected location, or to any seam which is known to communicate with the leaky seam or location, screw a pipe nipple into the hole and attach a small cylinder nearly filled with the thin mixture of tallow and red lead. Apply the air pressure to the cylinder from compressed air lines, which are used to operate air hammers or boring machines. This will force the red lead and tallow mixture into all communicating seams and thoroughly impregnate the surrounding area and crevices. An air pressure of from 60 to 100 pounds should secure the desired results. The red lead and tallow mixture used in and around the deadwood should be thin, having more red lead than tallow. In other parts of the hull where it is desired to gun a seam or crevice, a thick or pasty mixture should be used composed of more tallow than red lead. The purpose of the red lead is to prevent its caking quickly and also to poison the tallow so the rats will not eat it.

At the bow and stern, especially under the counter, the planks have to be shaped and their shape or the amount of *sny* or upward curve, is determined by *spiling*. Spiling or taking measurements is the reproduction on a batten and the transference of the exact shape and the bevel or bevels of the edge of the plank already in position, to the new plank to be shaped. This is accomplished in the following manner:

First. A thin, straight strip of wood about 4 inches wide, called a *spiling batten,* is tacked onto the frame as near as possible to the edge of the plank already fastened in place. In tacking the batten into position the edge is sprung as much as the batten will stand without buckling. This springing of the batten indicates how much it is possible to spring the plank without excessive straining, and shows that it is possible to use a narrower plank than would be required if the batten or plank could not be sprung. If the batten or plank was used straight, it is evident that in a very crooked or acutely bevelled plank it would be necessary to use very wide planks to obtain these shapes.

Second. Mark on the plank already in position and also on the batten, points, called *spiling points,* which are in practice usually at the center of each frame. These spiling points are numbered consecutively from fore to aft, and the numbers are marked at the spiling points on the plank and on the batten, and also on the new plank as the points are transferred from the spiling batten. This numbering of the points on the new plank enables the workman who places the new plank in position to determine its exact location.

Third. The curved or irregular line is reproduced on the batten in the following manner. Take a pair of carpenter's dividers, set to the maximum distance between the edge of the plank already in place and the nearest edge of the spiling batten plus about $\frac{1}{8}$ inch. Then prick off the distance on the spiling batten, taking

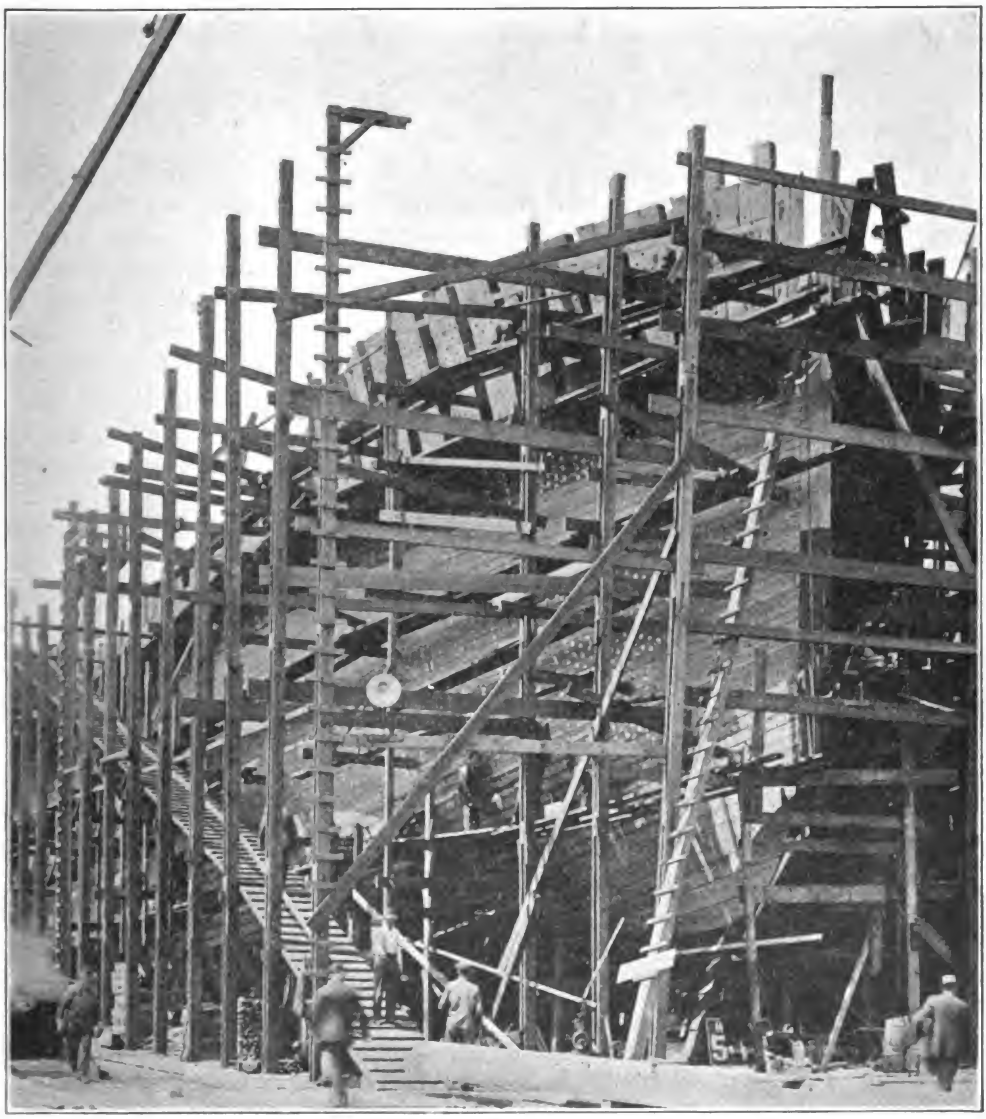


Fig. 51—Bow showing planking nearly completed. The small white spots show where iron fastenings have been used and the holes filled with wooden plugs dipped in white lead.

care to locate the prick points square out from the face or edge of the plank already in position.

Fourth. Take off the bevel, or out of square, that the edge of the plank in place has at the different spiling points. This can easily be done with a carpenter's bevel square in the following manner: Set the square to the bevel or angle the plank edge makes with the face of the frame and clamp the square tight; remove the square and mark the bevel on the bevel board, setting one side of the square against the straight side of the bevel board. When marking the bevel board, indicate the location number of the spiling point at which the bevel was taken.

Fifth. The points representing the curve or irregular line of the edge of the plank already in position, which have been pricked off on the batten, are then reproduced on the new plank. This operation is executed as follows: Tack the batten on the face of the new plank near the edge to be shaped; then with the dividers set to the same distance as before, prick off these distances on the plank from the spiling points on the batten, marking the location or corresponding number at each prick point on the new plank. Then take a small square batten and bend it so that one edge passes fair through all the points pricked on the new plank and mark plainly on the new plank a line drawn along the square batten which will pass through all the points which have been pricked off on the new plank. This line is a reproduction of the curved or irregular line of the edge of the plank already in place.

Sixth. The bevel of the edge of the new plank, which is to set against the edge of the plank already in place, must now be marked or indicated on the face of the new plank, so that the operator on the ship's band-saw or edge-bevelling machine can cut the bevel exactly, to make the plank fit perfectly without any hand operations or dubbing. This operation is performed in the following manner: Take the bevel board and from the bevel line drawn on the board determine the amount of bevel at each spiling point in inches, if the bevelling is to be done by hand, and in degrees, if the bevelling is to be done on a machine (ship's band-saw or edge-bevelling machine). Also indicate on the face of the plank whether the bevel is *standing bevel* (marking "S") or *under bevel* (marking "U"). The new plank is then ready to be shaped either by hand or machine. The methods to be used in shaping are similar to those described under "Stem, Stern-post, and Frames." (See page 16.)

In planking the ends of the ship and the bilges it is necessary, in order to fit the planks into position, to soften them by steaming in a steam box or immersing in a hot water box or tank. If planks cannot be obtained wide enough to cut all the curve required, the difference between what can be cut and what is needed is obtained by straining the plank edgewise, or *edge setting,* as it is called. This is done by the use of small jacks butted against a *stud,* dolly, or short bar of iron, set in a hole bored in the frame. After the plank is on, the stud or dolly is removed and the hole plugged.

In planking the sides of the ship there is generally nothing to brace against as there was under the ship's bottom, and the ceiling on the inside prevents the hooking of screw clamps over the frames. Therefore, either the ring staff is used (as explained above in the description of putting in the shelves and clamps), or a screw clamp with sharp prongs, called a *devil's claw,* is hooked into the side of the frame. This form of clamp is strong enough where there is not much spring to the plank,

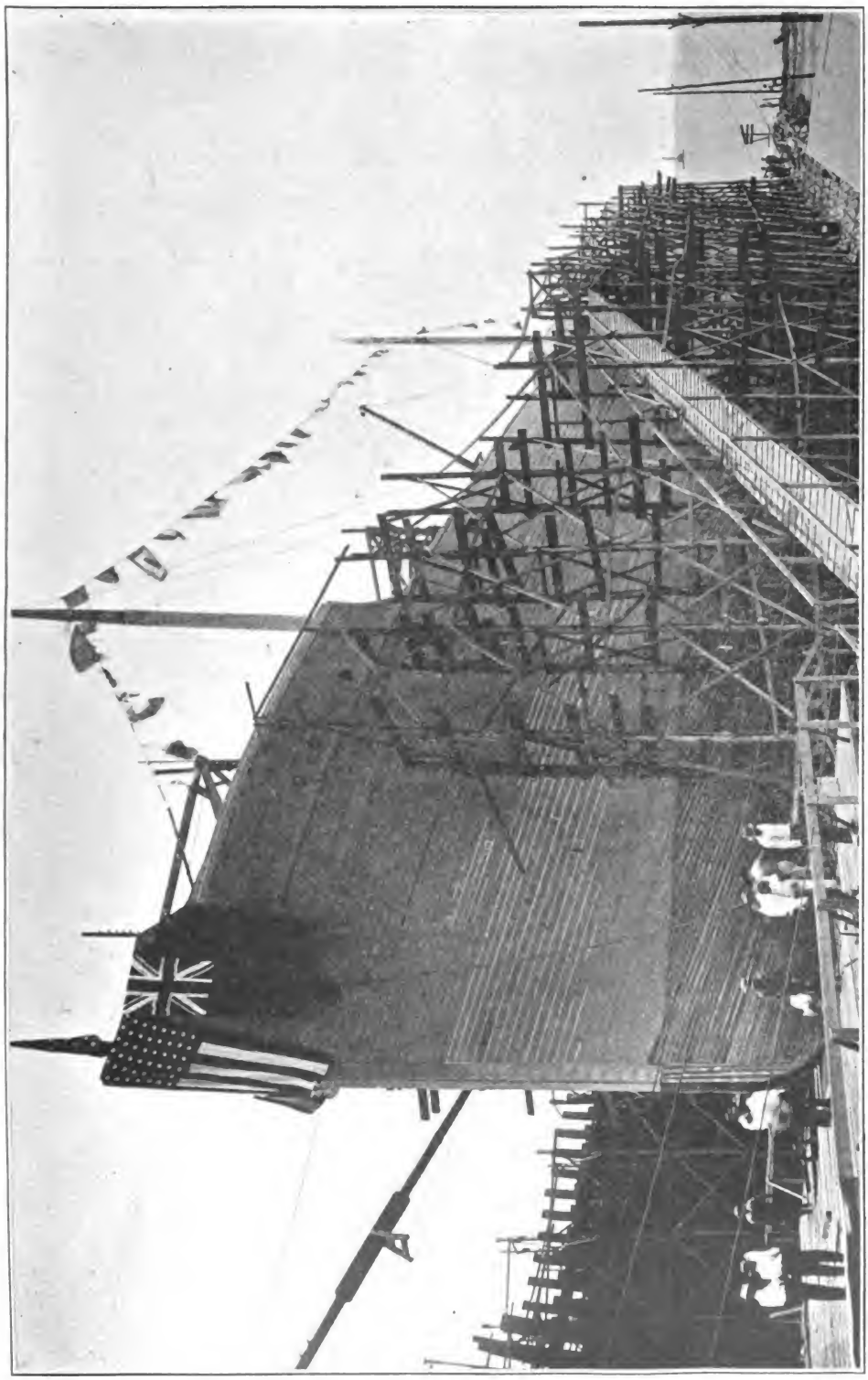


Fig. 52—Bow showing planking completed. Vessel calked to above the water line and ready for launching.

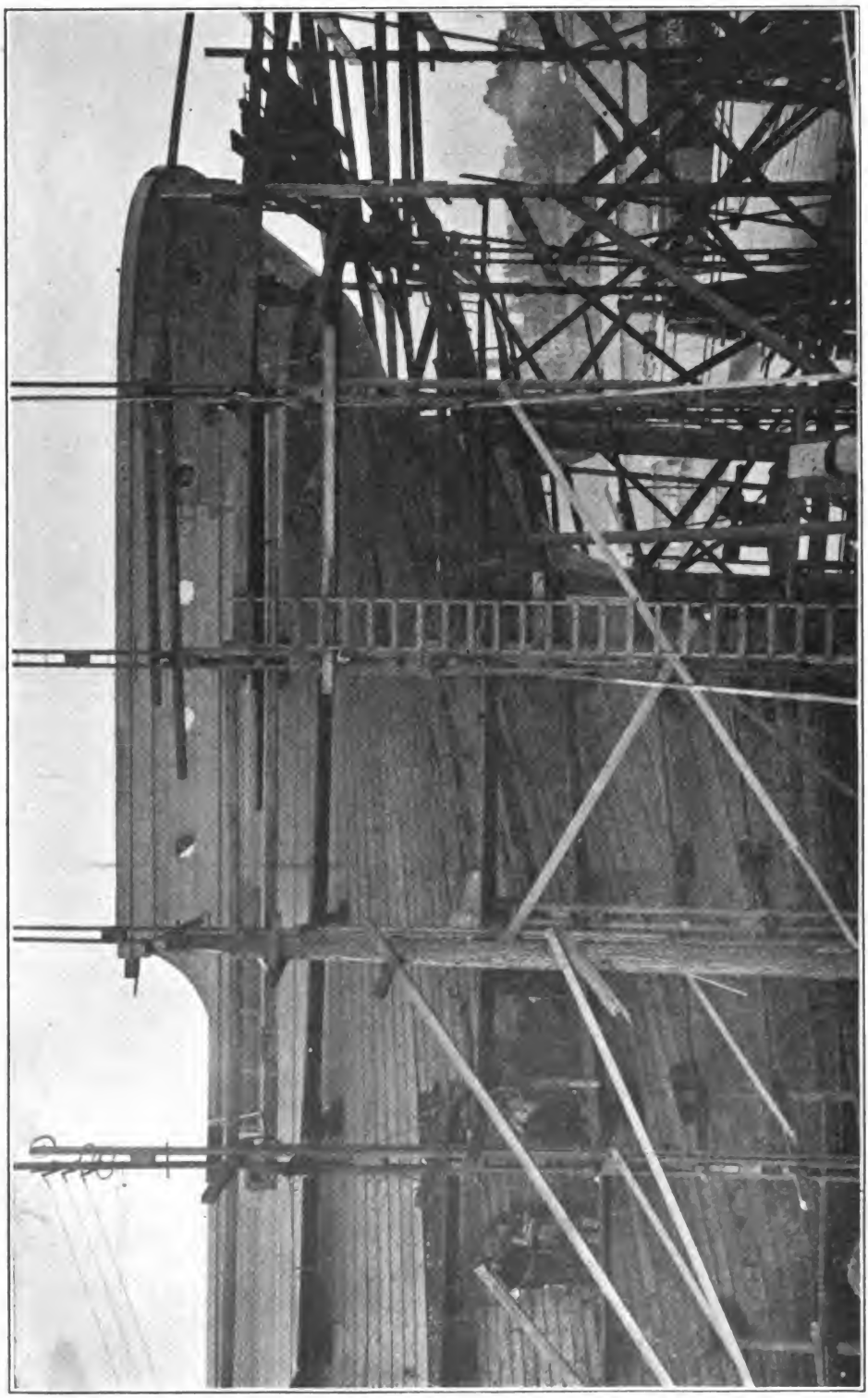


Fig. 53—Stern showing overhang, planking completed. Arch knees, joining and stern post, packing pieces and rudder post.

as on the sides. The most useful device, however, is an *iron toggle bar* (see Fig. 64), that jams tight between the two frames when a clamp is hooked on it and set up. Near the ends of the ship where there is a very heavy strain in bending the planking into place, the *grasshopper clamp* or jack is used (see Figs. 47 and 64). Another handy device is a new form of planking clamp which is pushed in between two frames, and by a cam motion jams so that it will not come out when a strain is put upon it.

CALKING

When the ship is planked, the seams are spread open by a *reaming iron* and oakum, or cotton, spun into thin strings, is tucked in with a *calking iron* and then driven up hard with a blunt, wide-bladed tool, called a *hawsing iron,* set in a loose handle so that one man can hold the blade on a seam filled with oakum, while another man hits it with a heavy mallet called a hawsing beetle. The seams are then painted or paid off with a narrow brush, called a *seam brush,* which resembles a toothbrush with one row of bristles, and are then filled, either with a mixture of Portland cement and lamp black, or with a mixture of white lead and tallow.

LAUNCHING

The ship is then painted above as well as below the water line. Before the ship is ready for launching there are several fittings to be installed by the engineer in charge of the machinery installation. The shaft hole, which was made about two inches smaller in diameter than the size shown on the drawings, through the stern-post and shaft log must now be bored out the full required diameter the bronze, brass, or copper stern tube or copper lining to the shaft hole must be put in; the stern tube bearing, stuffing box, tail shaft, and propeller must be installed; the steel cheek plates must be fitted and fastened and riveted to the boss of the stern-post; the stem iron must be fitted and fastened in place; the copper ribbon and through bronze bolt for the wireless ground must be secured in place on the outside of the bottom amidships near the keel, and all the sea connections must be completely fitted to the ship's side and bottom. The ship is then ready for launching.

Greased timbers, called *ground ways,* are put under the bottom of the ship almost directly under the girder keelsons halfway out from the keel to the bilge. These ways extend well down into the water. On top of these, for about five-sixths of the length of the ship, other greased timbers, called the *sliders, sliding ways,* or *cradle,* are placed. Before placing the cradle on the ground ways wide, flat bars of iron are laid about 8 feet apart on the surface of the ground ways. The cradle rests on these bars of iron until the wedges are ready to be driven up tight, preparatory to launching. At that time the bars are withdrawn and the cradle lowered until it rests on the greased ground ways. The cradle should be made in several pieces so as to be flexible and thus prevent the ends from sticking in the mud when the ship is launched. The after piece of the cradle should not be more than 50 feet long. Wood *packing* is fitted in snugly between the outside planking and the cradle. The hull is then ready for launching. The hull is raised off the keel blocks by driving wedges between the cradle and the packing. Then the shores and keel blocks on which she was built are knocked and split out, throwing the entire weight of the finished hull on the cradle

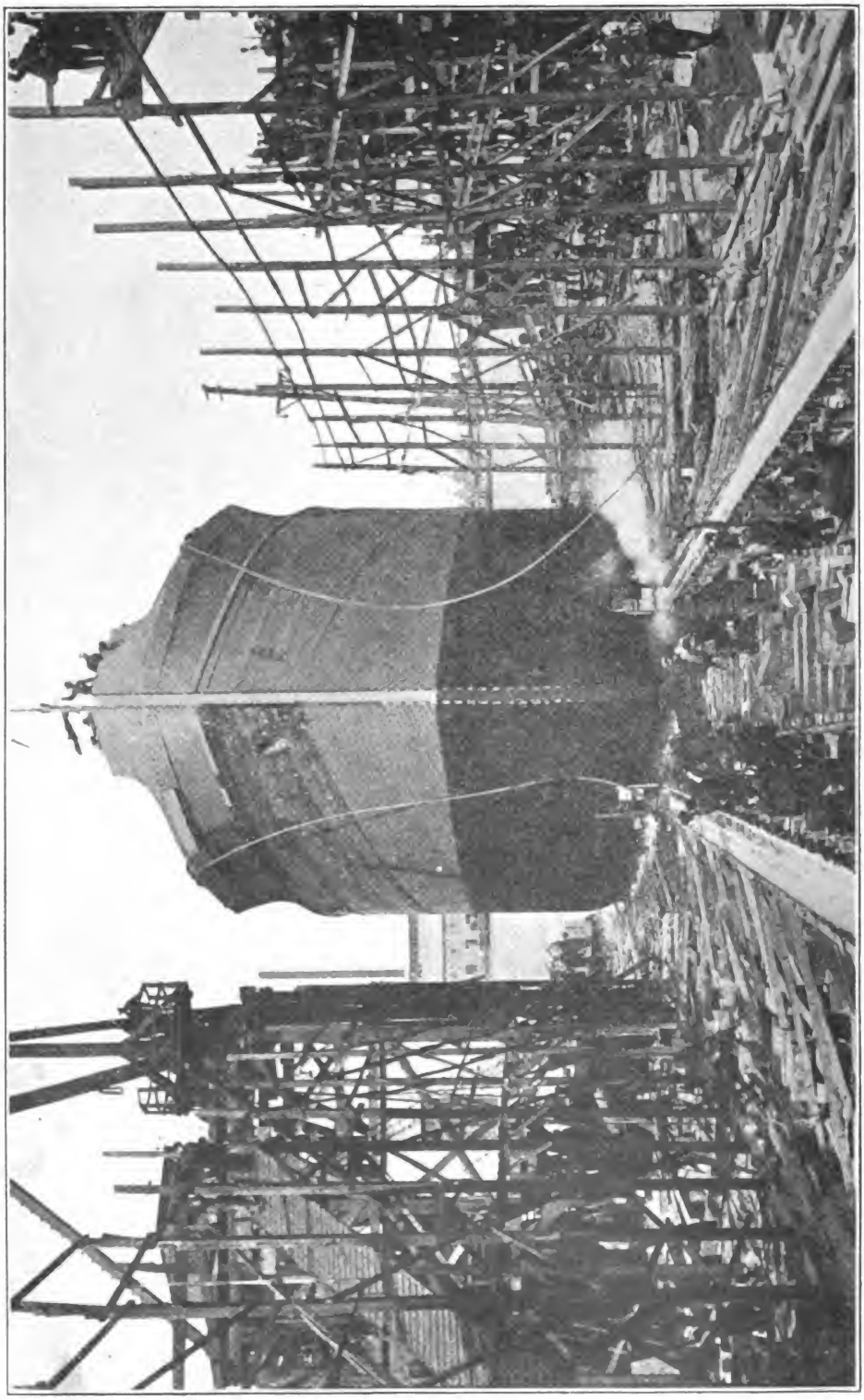


Fig. 54—Launching a 3500-ton D. W. C. Ferris-type wooden steamship, showing launching ways, cradle at forward poppet, and cables for retarding the momentum, due to launching.

resting on the greased ground ways, and at high tide the cradle is released and the hull and the cradle slide down the ground ways into the water. It is important that the hull should not be wedged up off the keel blocks very long, as the great weight of the ship may cause the tallow or grease used to lubricate the ground ways to flow out and leave no lubricating material under the cradle. The hull would not launch under these conditions. On the Great Lakes vessels are launched sideways; the general principles of launching are similar, the ways running athwartship instead of fore and aft.

A ship is not completed, however, when she is launched. There remains much to be done, work in which men of all trades can participate. Everything that goes into a small-sized hotel goes into a ship, as well as tons of machinery of different kinds. In building a ship there is work for all hands and trades.

FASTENINGS

One-half of the secret of good wooden ship building is in making perfect joints in all the pieces of wood that are fitted together; the other half is in properly fastening the pieces together. In the olden days, oak—good, clear, sound white oak and live oak, not pin oak and red oak—were the only woods considered fit for shipbuilding. Live oak, when kept under water, as the ship's keel is, will last a hundred years or more and white oak will last nearly as long. But today it is impossible to get enough of these woods to build any quantity of shipping so it has been found necessary to resort to Southern yellow pine and Douglas fir. Southern yellow pine is the most abundant of all ship materials and is extensively used in building wood ships along the Atlantic and Gulf Coasts; Douglas fir is used on the Pacific Coast. Vessels built of these woods are classed as soft wood ships and their length of life is comparatively short as rated by marine insurance companies.

Steel or iron drift and clinch-bolts are used to supplement treenails in the fastenings. They are generally driven by air hammers in holes bored 1/16 inch smaller in diameter than the bolt. An iron bolt driven into an oak timber will cling to that timber and "grow fast," especially if it be black iron, while a composition bolt will form a film-like verdigris around it that allows it to slip. Iron bolts will in time deteriorate but bronze or yellow metal bolts will last indefinitely. In oak the fibres are so closely knit that an iron bolt subjected to a heavy strain will not cut into them, but in yellow pine the fibres will compress so that the hole becomes elongated and the bolt loosens. All scarfs, therefore, should be well fitted and snug at the ends and all joints should be perfectly fitted so as to prevent any motion from starting. Where bolt heading machines are available, the iron may be heated and then headed to any desired shape. Blunt bolts are those that do not go entirely through the materials to be fastened together, and clinch-bolts are those that do go entirely through and have their ends hammered over, upset, riveted, or clinched over iron rings called *clinch rings*. All fastenings, whether of iron or wood, are driven into holes bored for them so as to prevent

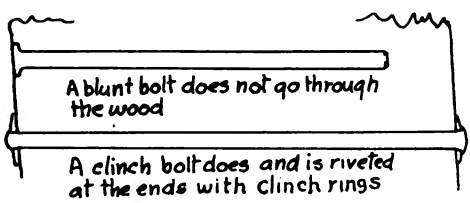


Fig. 56—Blunt and clinch bolts.

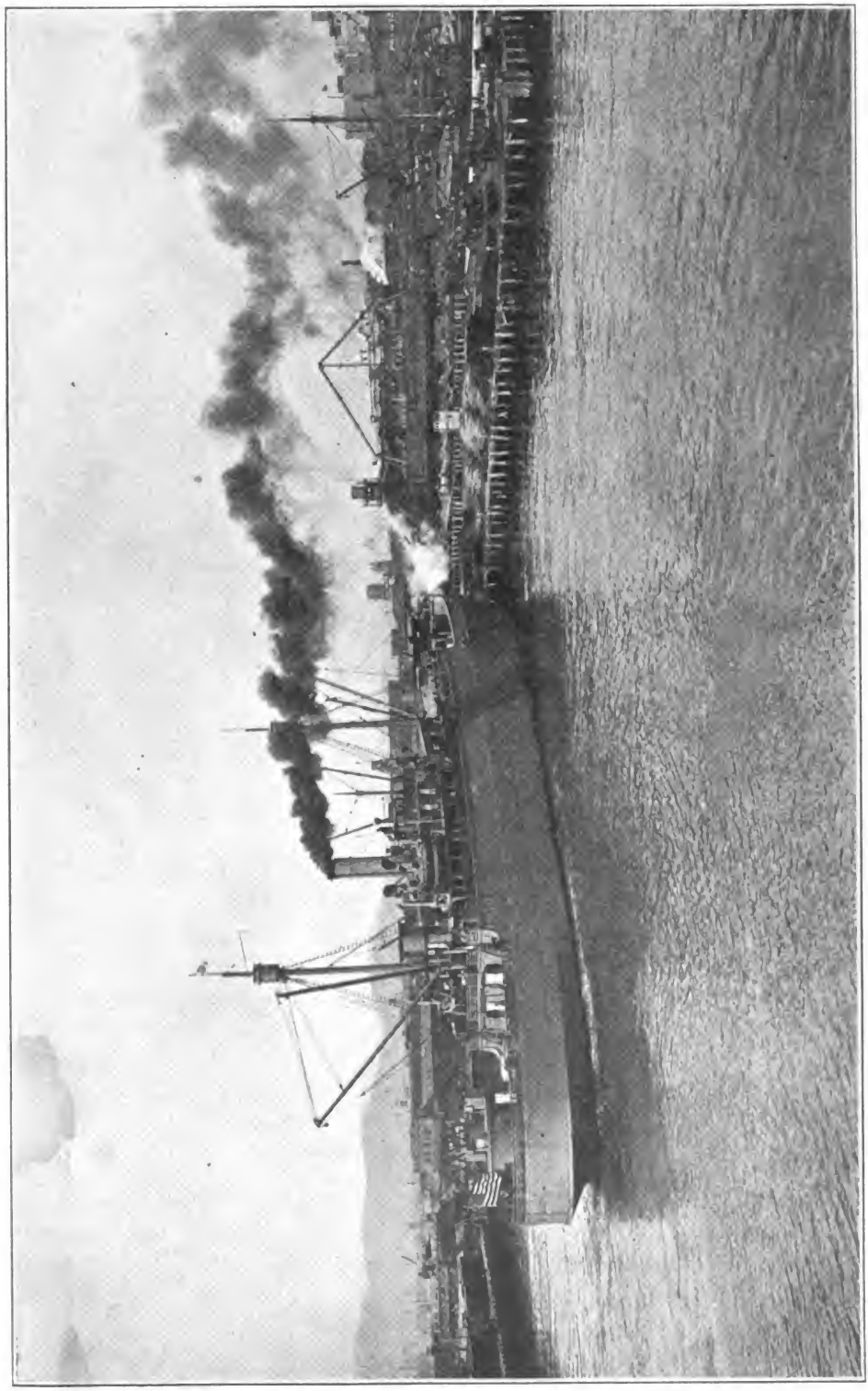


Fig. 55—Hough-type wooden steamship under steam.

splitting the grain of the wood. These holes are from 1/8 to 1/16 inch smaller than the fastenings used.

The holes in clinch rings should be *chamfered* or countersunk, at about 10 to 12 degrees from the vertical, so that the bolt end, which should extend about one-half its diameter above the ring when ready to clinch, may be swelled out by hitting it smartly several blows on the end with a round-faced top maul and finishing it up to fit snugly in the countersink with a round or ball-peen heavy machinist's hammer. This expands the bolt end, *upsets* it as it is termed, so that the bolt swells out and fills the countersunk hole in the clinch ring. The upsetting of the head of the bolt is the most important feature of this method of fastening. As the strain put upon the timber tends to draw the bolt out, the head wedges down into the clinch ring. The broad, flat surface of the clinch-ring has sufficient area bearing on the wood to prevent the pressure of the bolt from forcing the ring into the wood and becoming loose enough to let the fastened timbers open apart. Each bolt should hold its own share of the pull for in unity there is strength. If all the bolts pull equally there will be no give to the structure.

After swelling the *neck* of the bolt in the ring, a rounded head is made on it by hammering around the edge of the bolt with a flat-faced top maul, sledge, or an air hammer. Many beginners simply smash away on a bolt regardless of how they mash the end of the iron as long as they drive it into the wood. This is not fastening the

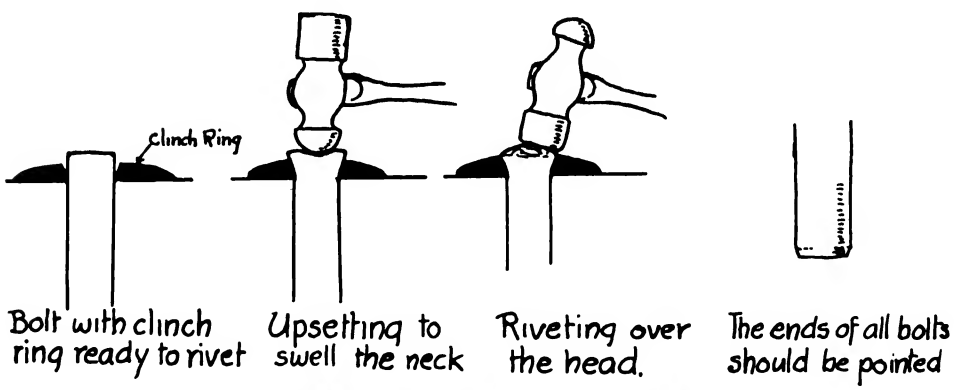


Fig. 57—Upsetting and riveting bolts.

ship—it may split the end of the iron so that its top looks like a cauliflower, but all the split ends do not make for strength. If a slight crack starts in the burr or turned-over edge of an iron bolt, the cracked spot should be hammered so as to compress and close it, making a smooth button head, and thus prevent its opening further. If you keep on hammering on the center, the crack will continue to grow larger.

All bolts should have their ends slightly pointed by hammering the sharp edges on the end so that they will follow the hole and push the wood aside, and not cut a shaving of wood ahead of them.

Clinch-rings should be forged from iron or steel, punched out of steel plates, or made out of malleable iron. A properly made clinch-ring, punched out of mild steel, will stand being bent over double without breaking.

Treenails are long, wooden pins, resembling broom handles, usually more than one inch in diameter and from 26 to 30 inches long, and are used for fastening the different parts of the frame together as well as for fastening the planking and ceiling to the frames. Treenails are also part of the fastenings used in assembling stem and stern-post and shaft log together. They are of hard wood, either black or yellow locust, iron bark, live oak, osage orange, or bois d'arc. Treenails are usually driven entirely through the timbers so that each end may be split and small wedges driven in to expand the ends. They are made of split wood so as to get straight, sound grained wood, as a cross-grained or knotty piece would break in two with the pressure, while being driven through the bored holes. Treenails are turned in a lathe or a special machine either perfectly round or eight-sided. Where very long treenails are to be driven, they are made *two drift,* or smaller in diameter for the first or inner half of their length, so that they enter half-way into the hole before they fit snug. The hole is bored with two sizes of bits. This reduces the length they have to be driven hard, at least one-half.

For "sticking" the planking to the frames and other preliminary fastenings, treenails are driven home with a maul or air hammer. For the smaller fastenings, square spikes are used.

Fastening is a trade in itself. The men who do this work are classed as *fasteners.* Working in conjunction with them is another class of craftsmen called *borers.*

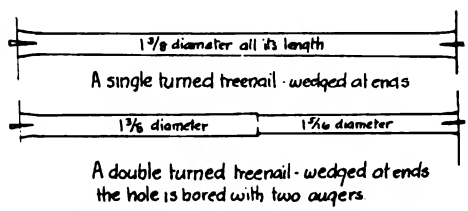


Fig. 58—Single and double drift or turned treenails.

Holes are usually bored with an auger about 1/16-inch smaller than the bolt, but in hard wood, such as oak, an auger of the same size may be used. A hole bored one day and left over night before the bolt is driven in will sometimes, on account of damp weather, swell so that the iron bolt drives in very hard.

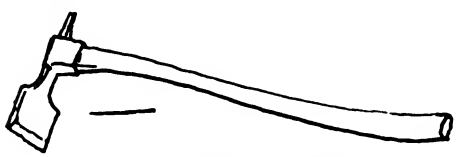


Fig. 59—Straight Adz.

Fig. 60—Lipped Adz.

Fig. 61—Lining Adz.

Fig. 62—Broadaxe.

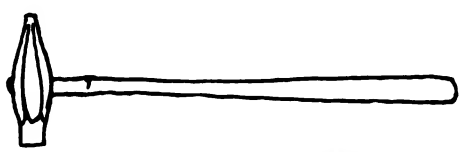


Fig. 63—Pin or Top Maul.

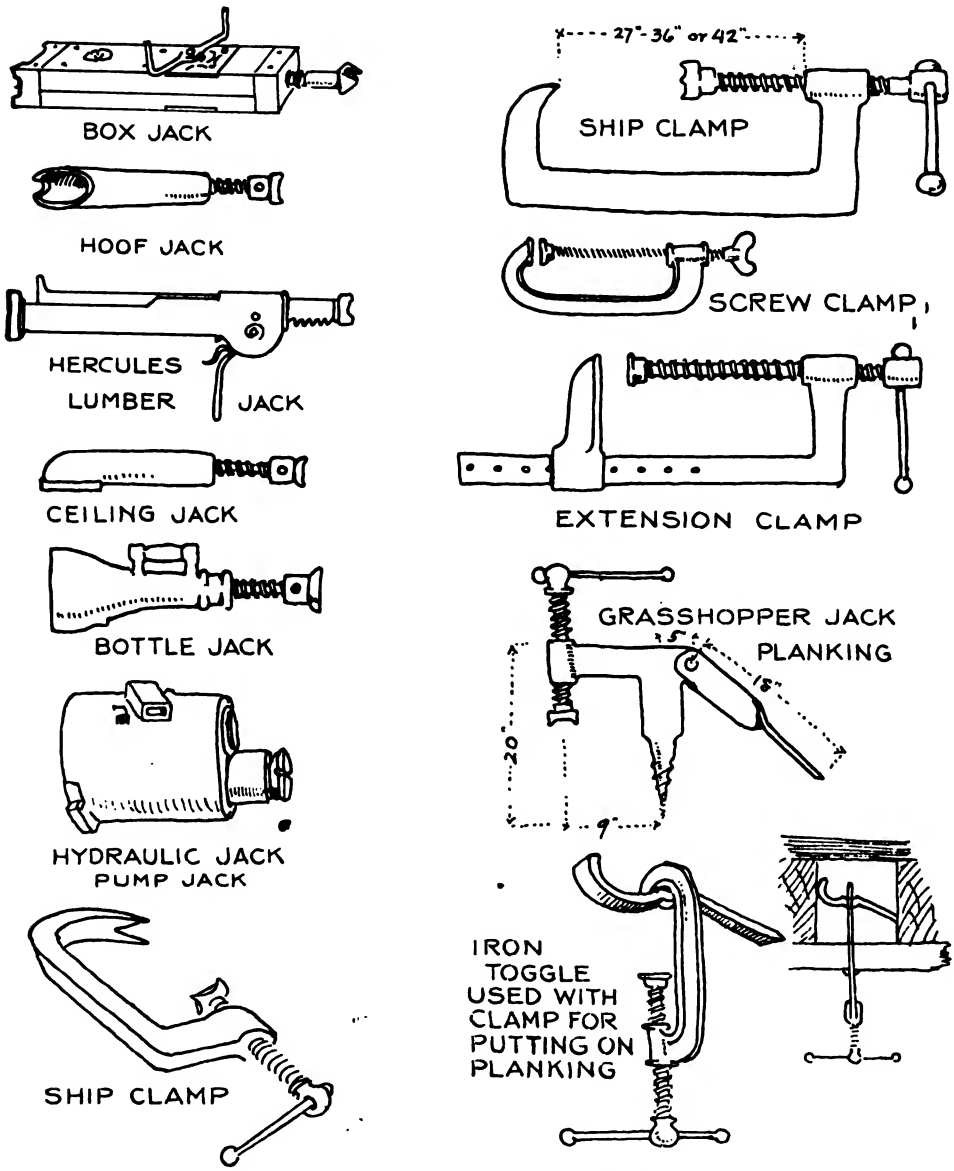


Fig. 64—Different types of shipbuilders' Jacks and Clamps.

Fastenings are never put all in a straight row, as this would bring them all in one grain or plane of the timber. Holes so placed might split the timber, as the bolts when driven would act like wedges. When many holes are bored in the same piece they are alternated from side to side, or *staggered,* as it is termed.

An *adz, broadaxe, 5-pound pin maul, and cross-cut hand saw* should be part of the kit of tools of every man who applies for work on wooden ships. These and a few wide *chisels,* a *mallet,* and a *slicer,* as big 3-inch chisels are called, are practically all one requires, and in many shipyards these are supplied to the men. The

shipyards usually supply the rest of the tools and have a regular tool room where such tools as *pinch-bars, augers, screw clamps,* etc., are kept. As the work on the ship progresses a tool box with *brace* and *bits, hand hammer, chalk* and *chalk line, plumb-bob, square,* and the usual carpenter's outfit will come in handy.

Fig. 65—Sketch showing how fastenings are staggered. Fastenings are never put all in one line, but are staggered from side to side so as not to split the wood by all being in the same grain.

A good workman will not start cutting a *rabbet,* as the notch in the stem and stern-post is called, with an inch chisel or a lathing hatchet. It is a waste of time and energy to nibble on a piece of 16 x 24-inch timber. Such toy-like tools and such inefficient methods will not give the foreman a very favorable opinion of your ability as a ship carpenter. This work is usually done with an adz or slicing chisel. Extreme care should be exercised in using an adz. It is a dangerous tool. Never try to make a cut if there is a chip on its edge. Keep your feet spread and cut between them. Do not lay an adz down sharp edge up; you wouldn't lay a razor down that way. Never leave tools so they will fall off the scaffold and perhaps cut or kill some man below you.

Augers, like saws, require constant attention. In one of the new shipyards as many as 998 ship augers of standard sizes were used, not including some two dozen of extra large sizes for special work. The cutting lip of an auger soon wears down and thus bores a smaller hole, so that bolts which would be driven in the holes made when the auger was sharp, cannot be driven through. Although the difference in the diameter of the hole may amount to only 1/32 or 1/64 of an inch, when an attempt is made to drive in a bolt 6 feet long, the difficulty will be readily appreciated. Owing to the multiplicity of fastenings, some put through from the inside and some from the outside, one may at times hit another bolt. This dulls the cutting edges on one side of the screw point and as a result that auger will *run* or bore a crooked hole.

No man, unless he has had experience, should be permitted to put a file to an auger or bit to remedy a blunt point. Many shipyards keep one or two men who are employed all the time keeping augers and saws sharp and in working condition. An inexperienced man may file the auger so that it cuts a different sized hole than is intended. Augers vary in size by 16ths of an inch, for example: 1 1/16 inch, 1/8 inch, 1 3/16 inch, etc. Augers with small screw ends, or *worms* or *tangs,* as they are called, are not adapted to general ship work; bare-foot augers are mostly used. Augers are known also as bits.

Volumes could be and have been written on all the various subjects relating to shipbuilding and fastening, but it is hoped that the few hints given in this pamphlet will aid many workmen unfamiliar with some of the operations in becoming of great assistance in the revival of this important industry—Wooden Ship Building.

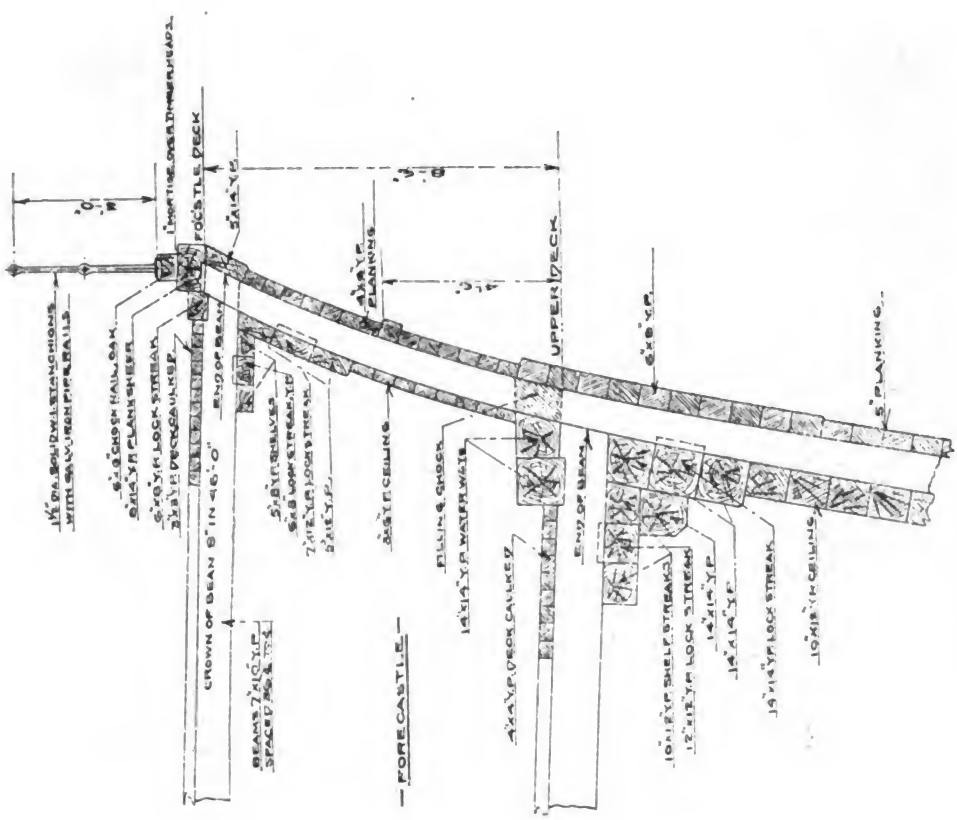


Fig. 68—Section through forecastle.

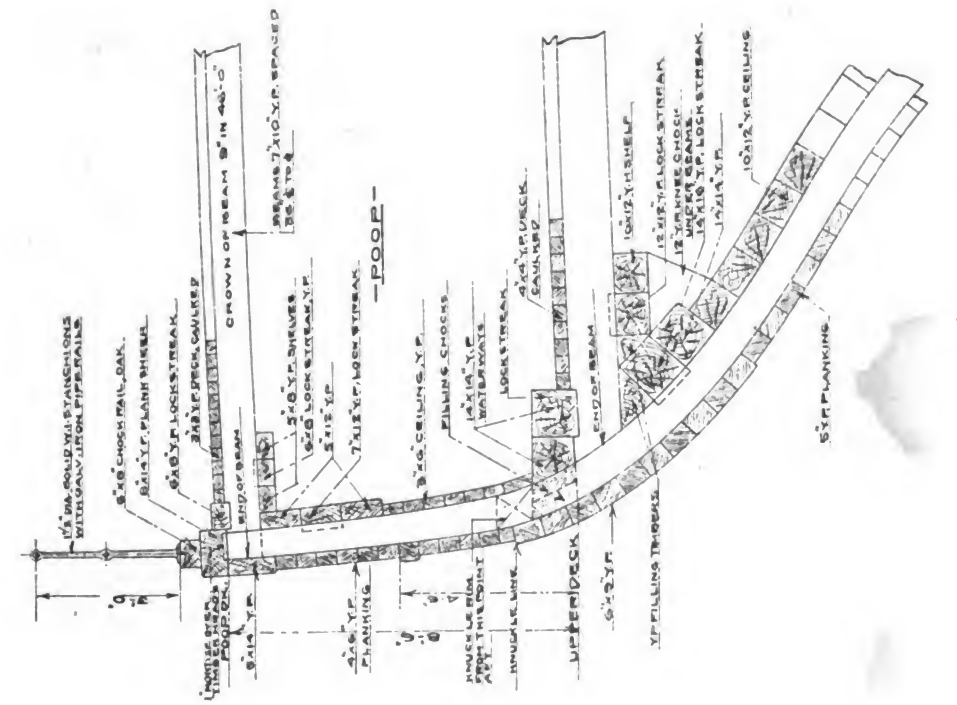


Fig. 69—Section through poop.

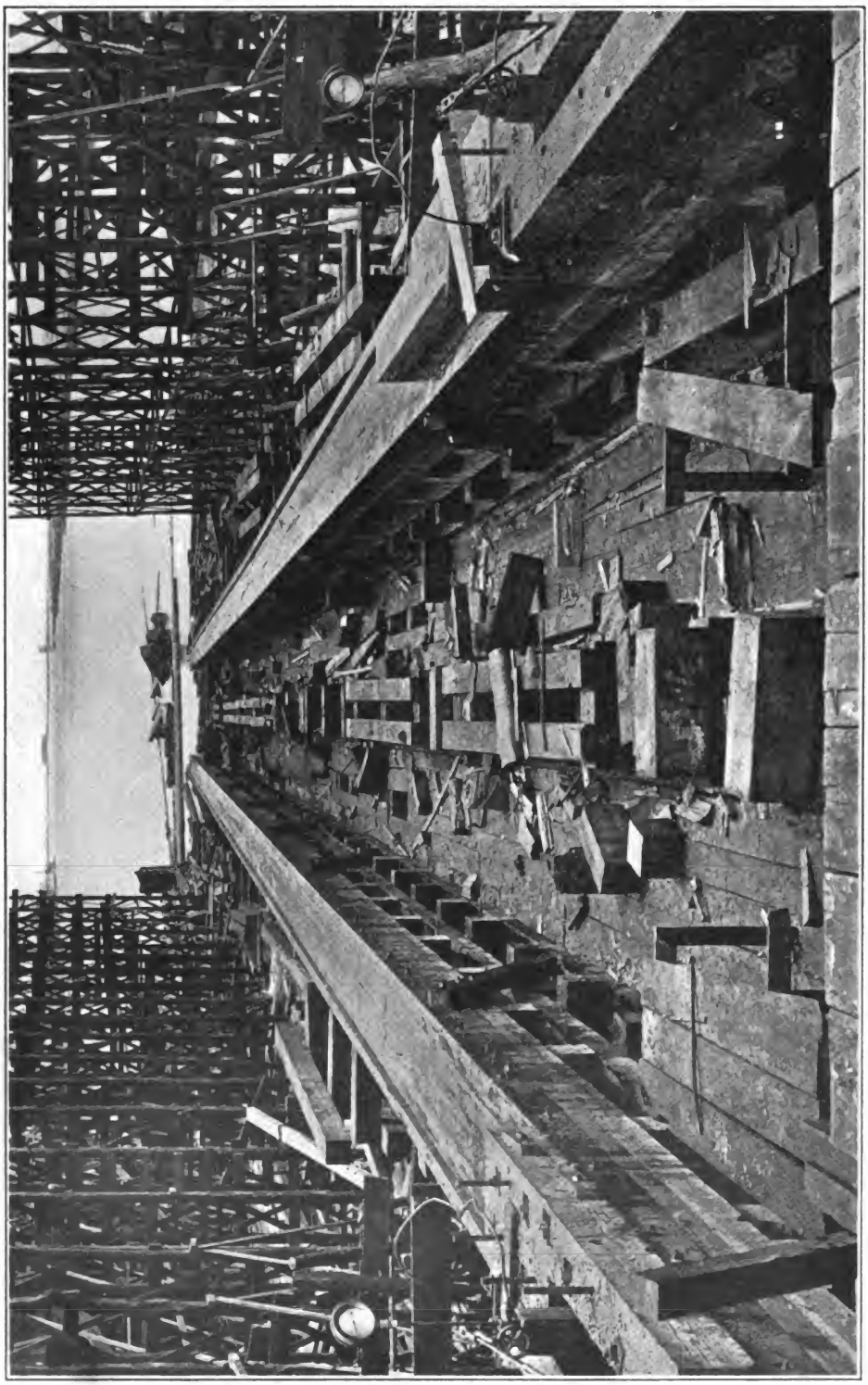
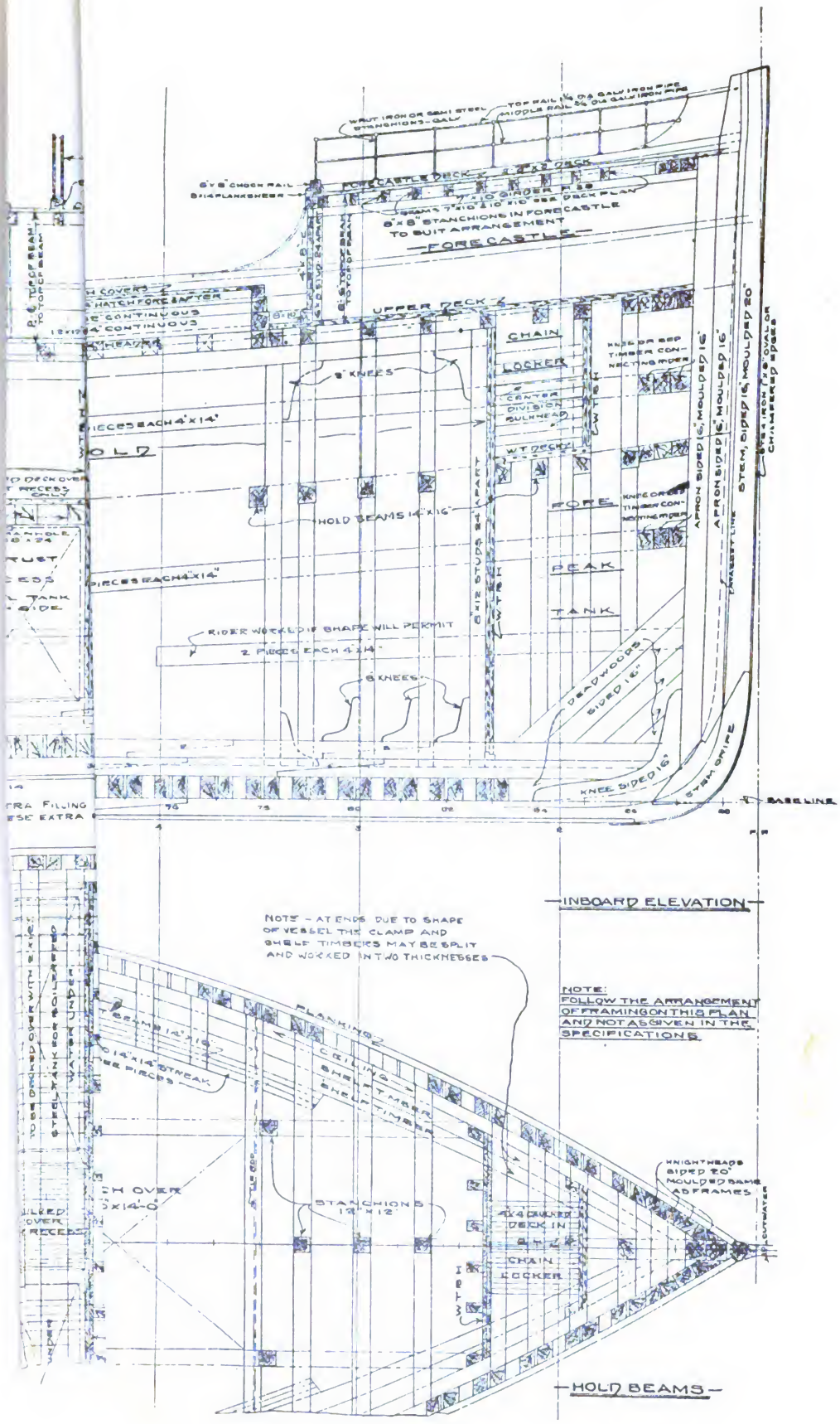


Fig. 71—Ground ways just after the hull has been launched, showing keel blocks, ground or standing ways with timber ribbon flange or guide on the outside, starting jacks; forward poppets and cradle afloat at end of outboard ways.



FORECASTLE DECK
8"x8" STANCHIONS IN FORECASTLE TO SUIT ARRANGEMENT
FORECASTLE
UPPER DECK
CHAIN LOCKER
CENTER DIVISION BULKHEAD
W.T. DECK
FORE PEAK TANK
HOLD BEAMS 14"x16"
PIECES EACH 4"x14"
RIDER WORKED IF SHAPE WILL PERMIT
2 PIECES EACH 4"x14"
8" KNEES
DEADWOODS SIDED 16"
KNEE SIDED 16"
STEM ORIFE
APRON SIDED 16", MOULDED 16"
STEM, SIDED 16", MOULDED 20"
BASE LINE
INBOARD ELEVATION
NOTE - AT ENDS DUE TO SHAPE OF VESSEL THE CLAMP AND SHELF TIMBERS MAY BE SPLIT AND WORKED IN TWO THICKNESSES
NOTE: FOLLOW THE ARRANGEMENT OF FRAMING ON THIS PLAN AND NOT AS GIVEN IN THE SPECIFICATIONS
PLANKING
CEILING
SHELF TIMBER
STANCHIONS 12"x12"
KNIGHTHEADS SIDED 20" MOULDED SAME AS FRAMES
CHAIN LOCKER
HOLD BEAMS

Fig. 72—Stern showing propeller boss and check plates on stern-post; rudder-post wheel arch knees and rudder. Outside of hull and rudder show method of protecting the timber work below the water level with a covering of tarred felt from the attacks of the teredo.

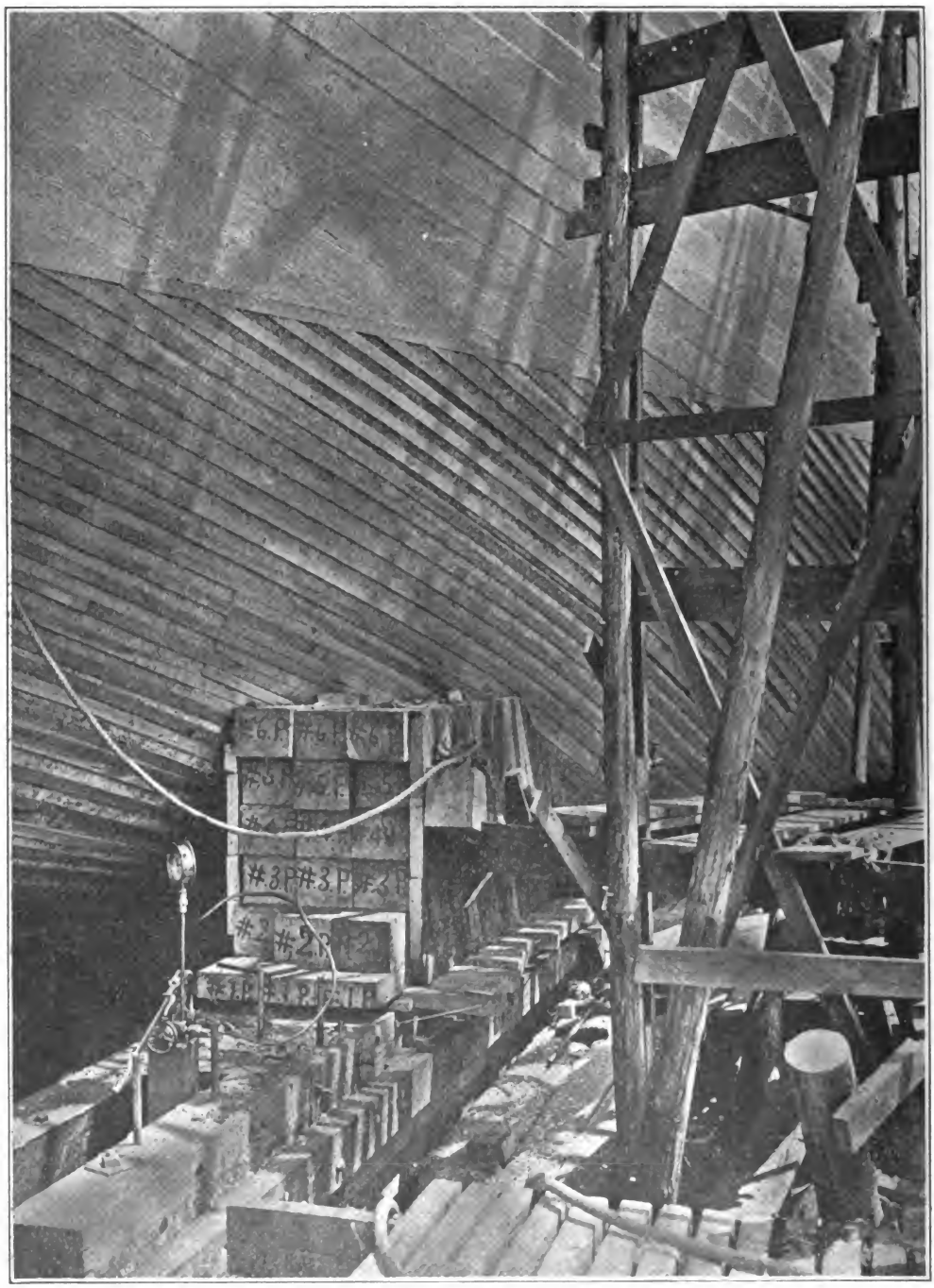


Fig. 73—Forward poppets looking aft showing ground or standing ways, starting jacks, scaffolding and method of protecting the hull below the water line, while outfitting ship, from the attack of the teredo. After ship is completed, ready to go to sea, she is dry docked for examination and this protective covering of tarred felt is removed from the outside planking.

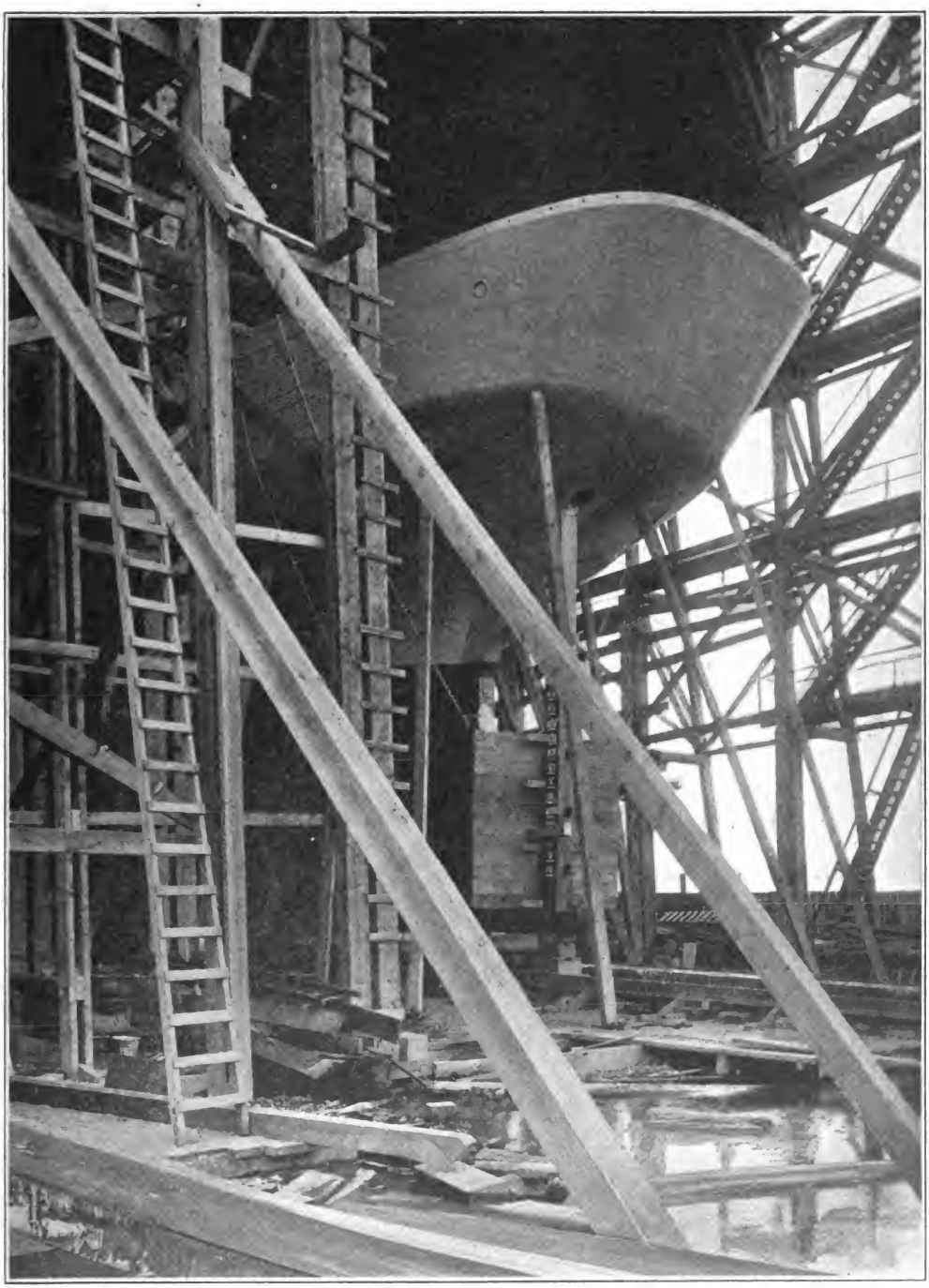


Fig. 74—Stern of a 3500-ton D. W. C. Ferris hull ready for launching, showing launching shield on forward side of rudder-post. The resistance of this shield against the water after the hull has left the ways. When launching, retards the speed obtained from the launching operation and assists in stopping the vessel quickly.

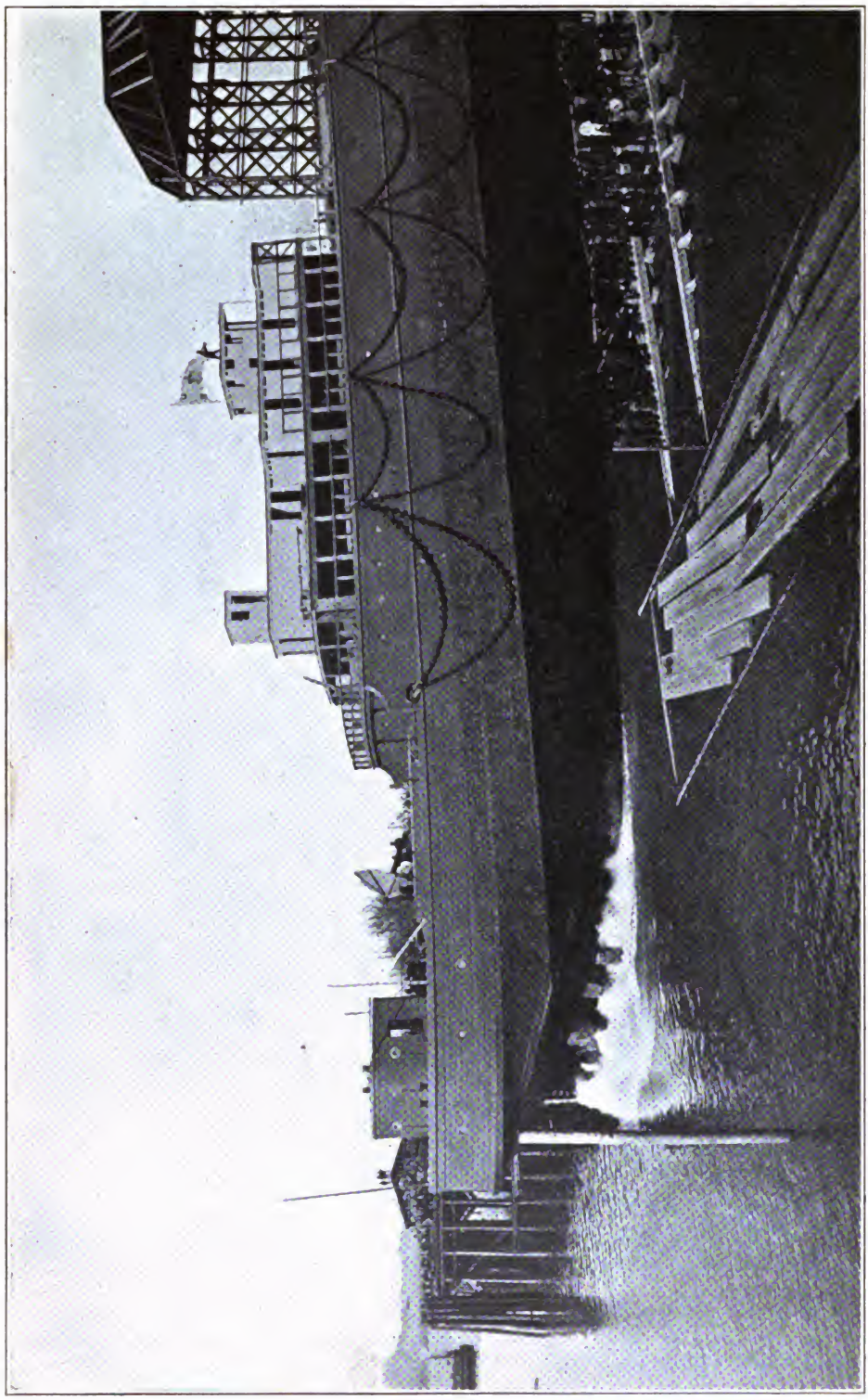


Fig. 75—Launching a wooden steamship. The chains shown looped up on the side of the hull are for the purpose of retarding or stopping the vessel after she is launched and afloat. These chains are secured on one end to heavy anchors or drags ashore, the other end to the anchor windlass on the forecastle deck. The slack of the chain is looped up along the bulwark rails with manila stoppers, which break or part when a heavy strain comes upon them. In this way the vessel is gradually brought to rest.

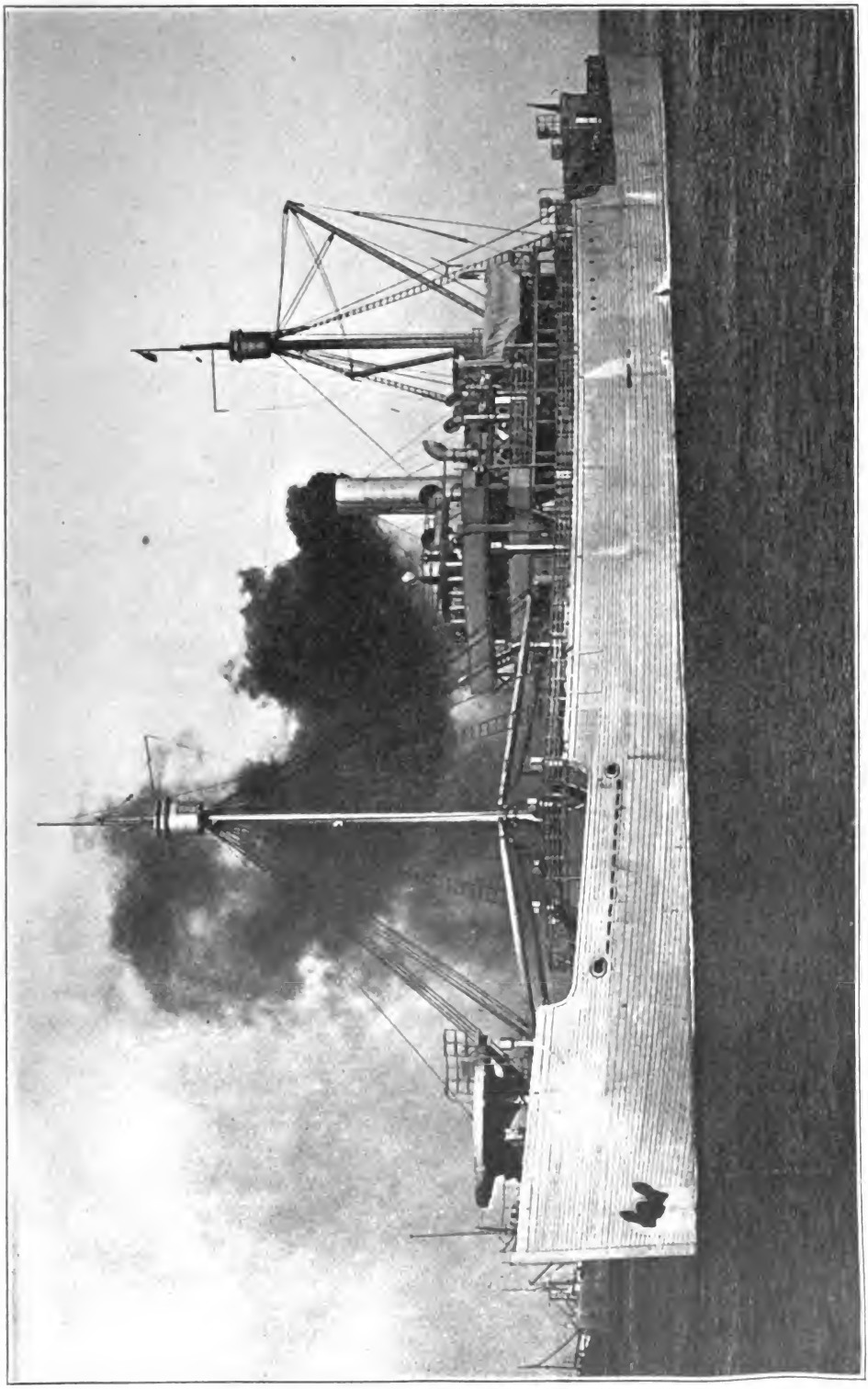
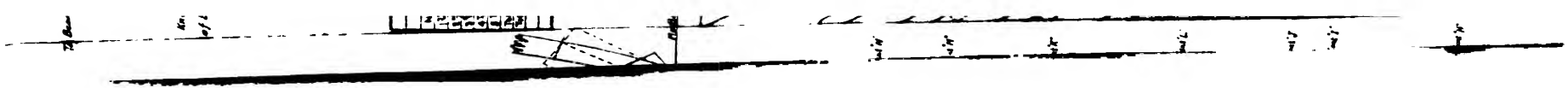
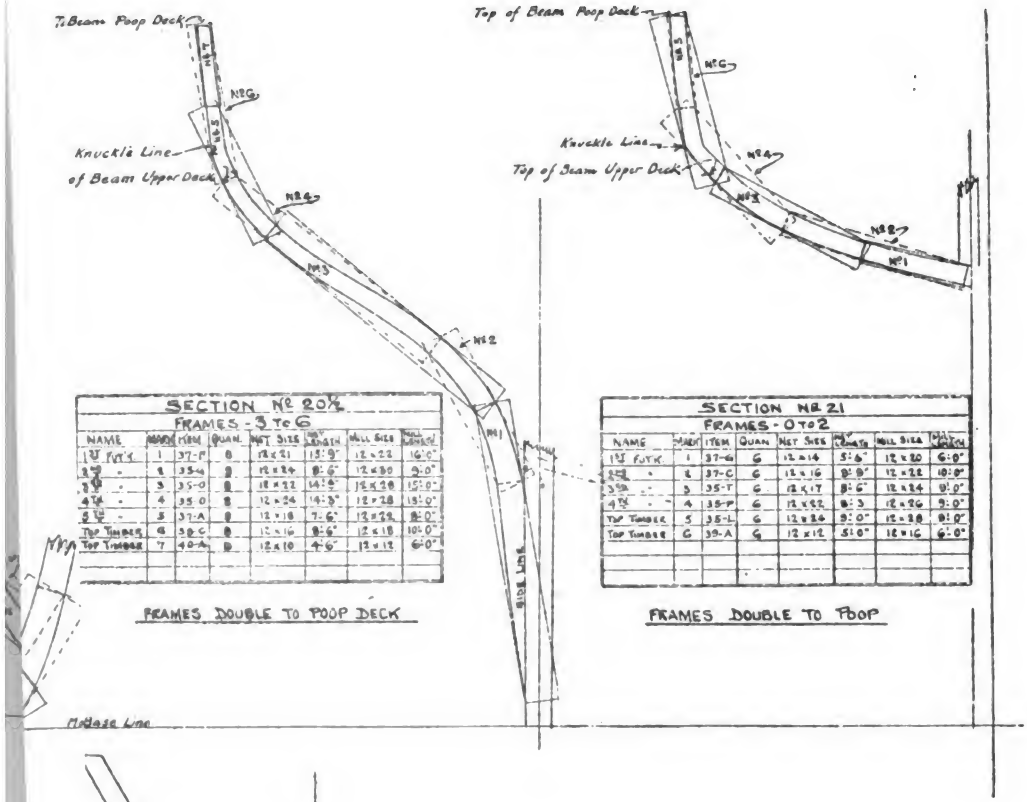


Fig. 76—A 400-ton D. W. C. wooden steamship leaving port fully loaded.





SECTION Nº 20½

FRAMES - 3 TO 6

NAME	MARK	ITEM	QUAN.	NET SIZE	NET LENGTH	MILL SIZE	MILL LENGTH
1½ F.V.K.	1	37-F	8	12 x 21	13'-9"	12 x 22	16'-0"
3½ "	2	35-4	8	12 x 24	8'-6"	12 x 30	9'-0"
3½ "	3	35-0	8	12 x 22	14'-6"	12 x 28	15'-0"
4½ "	4	35-0	8	12 x 24	14'-3"	12 x 28	15'-0"
5½ "	5	37-A	8	12 x 18	7'-6"	12 x 24	8'-0"
Top Timber	6	38-C	8	12 x 16	8'-6"	12 x 18	10'-0"
Top Timber	7	40-A	8	12 x 10	4'-6"	12 x 12	6'-0"

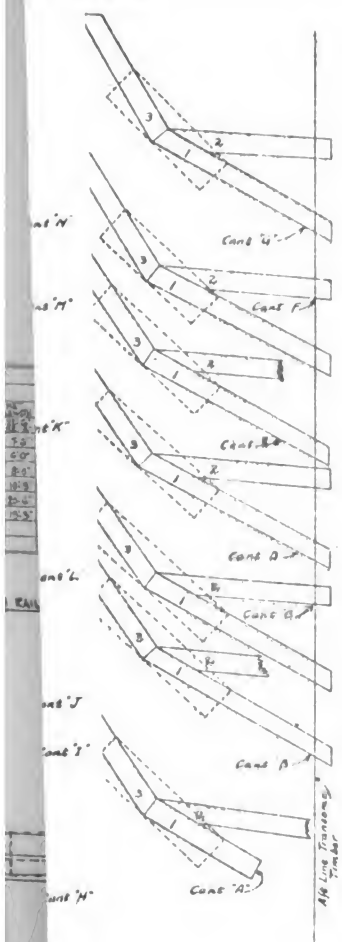
FRAMES DOUBLE TO POOP DECK

SECTION Nº 21

FRAMES - 0 TO 2

NAME	MARK	ITEM	QUAN	NET SIZE	NET LENGTH	MILL SIZE	MILL LENGTH
1½ F.V.K.	1	37-G	6	12 x 14	5'-6"	12 x 20	6'-0"
3½ "	2	37-C	6	12 x 16	8'-9"	12 x 28	10'-0"
3½ "	3	35-T	6	12 x 17	8'-6"	12 x 24	9'-0"
4½ "	4	35-P	6	12 x 22	8'-3	12 x 26	9'-0"
Top Timber	5	35-L	6	12 x 24	9'-0"	12 x 28	9'-0"
Top Timber	6	39-A	6	12 x 12	5'-0"	12 x 16	6'-0"

FRAMES DOUBLE TO POOP



CANT TIMBERS

10" x 24"						10" x 12"								
Extra Between Nos 23	Mill Length	Cant	Length	Number Pieces	Extra Between Nos 23	Mill Length	Cant Timber	Length	Number Pieces	Extra Between Nos 23	Mill Length	Cant Timber	Length	Number Pieces
6TA	7'	F	7'	2	66A	2'	F3	8'	2	66B	10'	B3	9'	2
"	"	G	7'	2	"	"	G3	8'	2	"	"	C2	10'	2
"	"	A	8'	2	"	"	H2	8'	2	"	"	C3	9'	2
"	"	D	8'	2	"	"	I2	8'	2	"	"	D3	9'	2
"	"	C	8'	2	"	"	I3	8'	2	"	"	E2	10'	2
"	"	D	8'	2	"	"	J2	8'	2	"	"	E3	9'	2
"	7'	E	8'	2	"	"	J3	7'	2	"	"	F2	9'	2
"	"	M	4'	2	"	"	K2	7'	2	"	"	G2	9'	2
"	8'	N	4'	2	"	"	L3	7'	2	"	"	H2	9'	2
6TB	9'	K	4½	2	"	"	L2	7'	2	"	"	I2	10'	2
"	"	L	4½	2	"	"	L3	7'	2	"	"	J2	10'	2
"	"	J	4½	2	"	"	M1	8'	2	"	"	K1	10'	2
6TC	12'	H	5'	2	"	"	M2	6'	3	"	10'	L1	9'	2
"	"	I	5'	2	"	"	M3	7'	2	66C	12'	B1	12'	2
					"	"	N1	7'	2	"	"	C1	12'	2
					"	"	N2	6'	3	"	"	D1	12'	2
					"	"	N3	4'	2	"	"	D2	11'	3
					"	"	P1	7'	2	"	"	E1	12'	2
					66A	10'	A2	9'	3	"	"	F1	11'	2
					"	"	A3	9'	2	"	"	G1	11'	2
					"	11'	B2	10'	2	"	"	H1	11'	2

- FIG. 70 -
PLAN SHOWING FRAME MOLDING

CANT FRAMES DEVELOPED AS PER STERN CONSTRUCTION PLAN Y.P. SHIP DRAWING Nº 36 ISSUED NOV-1-1917

SHIPBUILDING TERMS AND PHRASES

Shipbuilding Terms and Phrases

A

ABAFT—back of, behind.

ABOARD—upon or in the ship.

ABREAST—by the side of.

ACCOMMODATION LADDER—a stairway attached to vessel's side which can be lowered when required, giving easy access to the deck of a vessel from the level of the water. At sea this ladder can be unshipped and stowed on deck. In most vessels this is located amidships. Ships with only one accommodation ladder carry it generally on the starboard side.

ADZ—a hand-cutting tool having the blade at right angles with its handle; used with a sweeping blow for fairing or dubbing off timber. There are several kinds of adzes, the names they are called by indicating the particular purpose for which they are to be used.

AFLOAT—a ship is afloat after it is launched and is supported (floating) on the water. Afloat as opposed to aground or ashore—decks awash or flooded.

AFT—at or toward the stern.

AFTER—farther aft, nearer the stern "the after house."

AFTER-BODY—that part of the ship's hull abaft amidship section.

AFTER-HOLD—the hold in a vessel abaft the engine-room compartment when the engine-room is located amidships; the hold just forward of oil or coal bunkers, boiler or engine-room compartment, when located in the stern.

AFTER-HOODS—the end streaks of planking at the stern, terminating and fastened to the deadwood or to the rabbet in the stern-post.

AFTER-PEAK—the extreme after part of a ship's hold under the deck.

AFTER-PERPENDICULAR—a vertical straight line located at the after edge of the rudder-post; the after face of rudder-post—often referred to as A. P. on plans and specifications.

AFTER-RAKE—that part of ship's hull abaft the stern-post; the stern overhang; a term describing the inclination of the ship's masts, funnels or smokestack.

AFTER-SAILS—those sails carried on sail ship or steamer not spread on masts, booms or yards forward of the midship section of the vessel.

AFTER-TIMBER—those timbers in a vessel's hull abaft the midship's section.

AFTER-YARD—any yard carried on any mast abaft the midship section; the wireless yard on the main, mizzen or jigger mast.

AGROUND—not afloat; on the bottom—"the vessel is aground."

AIR-COURSE—see air-funnel.

AIR-FUNNEL—the air-course between the ship's frames, which provides ventilation and prevents decay of the timber framing.

AIR-HAMMER—a hammer driven by compressed air, used for driving drift bolts or pins, rivets, treenails and other fastenings; sometimes called an "air-gun" or "gun."

AIR-PORT—opening in the ship's side, house or cabins, generally fitted with a removable swinging cover; cover often equipped with a thick glass to admit the light to inside of vessel or compartment.

AIR-STRAKE—the openings left in ceiling over air-course or funnels between the frames, for the purpose of ventilating the ship's framing to prevent decay.

ALONGSIDE—close to the side of a ship.

AMIDSHIP—in the middle part of the ship, as refers to length or breadth; that part of a ship half way between the stem and stern or each side.

ANCHOR—a heavy steel or iron device, which, when dropped overboard to the bottom with an attached connecting cable, hawser or chain, is used to moor or hold a floating vessel in a desired location. There are many kinds of anchors, each designed for the particular location where carried on a vessel or for the service it is to perform and the kind of bottom or holding ground on which it is to be used.

ANCHOR-LINING—short pieces of hardwood planking, iron or steel plates fastened to the exterior sides of a vessel around or under the hawse pipe to protect the side planking and prevent the fluke or bill of the anchor from gouging or wounding the ship's side when housing, catting or "fishing the anchor."

ANCHOR-STOCK PLANKING—the planks which taper in width in both directions from the center of length.

APRON—the timber that reinforces the stem-post on the after or inside.

ARCH KNEES—timber, iron or steel knees fastened and riveted to stern packing pieces and upper part of stern and rudder-posts, shaped and fitted to form an arch between stern and rudder-post, at the top of opening over propeller.

ARMS—the projecting members of an anchor ending in a bill or fluke; end of a yard; "yard arm."

ASHORE—term applied to a vessel which is not afloat; vessel grounded; aground; on land, not on board the vessel—"The crew is ashore."

ASSISTANT KEELSON—the keelson timbers, which are along the outside and are fastened to the main or rider keelson.

ASTERN—behind the ship—"to look astern."

ATHWARTSHIP—across the ship, at right angles to the keel or longitudinal center line of a vessel.

AUXILIARIES—various winches, capstans, pumps, fans, generators, motors and other small engines or mechanical equipment generally applied to all mechanical equipment on shipboard except the main engines or boilers.

AWASH—level with the water; a condition of the vessel when the sea sweeps across the deck.

AWNING DECK—the highest deck which has an awning or light permanent shepter or superstructure built over it. This deck is used on some vessels for the stowage of lightweight cargo or for passenger accommodation.

AWNING STANCHION—a column or post forming part of the bulwark rail, which is extended up to carry the awning ridge or foot rope, to which the awnings are lashed or seized when they are spread. On most ships these stanchions are solid forgings, although piping stanchions are sometimes used.

B

BACKBONE—the assembled keel stem, stern-post and keelsons; the fore-and-aft rope sewed to the top or back of an awning, to which crowfoot ropes are spliced or thimbles are sewed securely in position. On the heel of the crowfoot into the thimbles the awning halyards or lanyards, which support the awning, are bent.

BACKING-OUT PIN—a pin used for backing out short or broken treenails or bolts.

BACK LEGS—a term indicating the struts or timbers bracing or supporting the mast of "a frame" or the mast of a stiff-legged derrick.

BACK RABBET—the innermost angle or line of the rabbet in the keel or any other part having a rabbet.

BACKSTAYS—shrouds or standing stays which are attached to or near the topmast heads and lead down to the bulwark channels or ship's top sides. These shrouds are set slightly abaft the mast and are used for the purpose of steadying or guying the topmast.

BACKSTAY STOOLS—independent small channels attached to bulwarks or vessel's top sides, abaft main channels used for securing the lower end of backstay to the deadeyes or turnbuckles.

BALLAST—any weight or weights used to trim the vessel or keep her from becoming top-heavy or capsizing; ballast is usually carried in the lower hold under the cargo. It may be fresh or salt water, gravel, shingle, pig-iron, steel rails, etc.—a term applied sometimes to cargo which is carried free, or for less than the usual or prevailing rate, the purpose being to increase the stability of the vessel, thus securing a favorable insurance rate and enabling her to go to sea and voyage safely from port to port.

BAR—a shallow place in the water, generally across the mouth of a rivet or harbor.

BARREL—the revolving part of a winch, windlass, capstan or hoisting engine, over which ropes, cables or hawsers wind; the horizontal drum or cylinder permanently attached to a steering-wheel around which tiller-ropes are wrapped.

BARREL-BOTTOM—a term descriptive of a vessel with a round bottom like a barrel.

BARREL-HOOKS—the special shaped hooks attached to a hoisting fall which can seize or take hold and lift a wooden barrel. These hooks grab the barrel in the chimes or end of the staves.

BARREL-SLING—a sling or method of attaching a rope used for hoisting a headless barrel.

BATTEN—a thin strip of wood, used by ship's carpenters to reproduce the curves or irregular lines of a vessel's hull. (See text description of taking spiling Pages 50, 51).

BATTER—when referring to a vessel, it is a term indicating that the topsides at the upper deck have less breadth than the sides at the water level. The backward or upward slope of the side of the ship from the water level. Sometimes referred to as vessels with "tumbled home sides."

BAYS—a term indicating amidship.

BEAD STRAKE—a continuation of the bulwark's rail across frames at bow, stern and amidships where ship's frame and sides are carried up higher than rails to support a higher deck; a finish to the topsides.

BEAM—an athwartship member supporting a portion of a deck; the width of the ship; off to one side "on the beam"; a vessel laying on her side—"on her beam ends."

BEAM KNEE—the knee at the end of a deck-beam, by which it is fastened to the hull framing.

BEARDING-LINE—the line developed by the inner edge of the planking surface against the forward and after deadwood, stem-keel and stern-post.

BECKET—a strap with an eye-splice at each end; the strap is passed around the mast, one eye passing through the other. The sprit for a sail or hook of a block can be attached in the loose eye, and the weight or strain will set the becket or strap tight on the mast and prevent it slipping; a cleat; a small gromet.

BEETLE—a heavy wooden mallet used in driving wooden wedges, treenails, pegs and stakes.

BELAY—to make fast a rope by winding or twisting it around a cleat, bollard, bitt or belaying pin; to attach a rope to a thing by encircling or surrounding it.

BELAYING POST—see *Samson post*.

BELOW—below deck or decks, corresponding to "downstairs."

BEND—to make fast or secure the ends of a rope or hawser to the clews of a sail, gaff or yard and mast; to secure one rope to another rope, spar, box, bale, barrel, etc.; "bending a sail or awning"; to open up or spread and secure in position a sail or awning to a yard, boom, gaff, mast, lines, ropes, etc.

BENDS OR WALES—strakes of thick planking on the vessel's topsides.

BENTINCK SHROUDS—a temporary rope or stay with the upper end lashed to weather side of crosstrees, running athwartship diagonally down across the mast, with lower end made fast to the leeward channels and set up taut. This shroud is for the purpose of bracing the mast and is used when the vessel is in heavy weather and rolling badly or when additional bracing is required for the mast when putting heavy cargo over the side with the vessel's own gear.

BERTH—the shelf-like bed or bunk used on a vessel by the crew or passengers to sleep in; a location at which a vessel "lays" or can "lay" whether at anchor or at a wharf or dock.

BEVEL—any inclination of a surface other than 90 degrees; if the angle of the side or edge of a timber or plank is greater than 90 degrees, it is called "*out square* or *standing bevel*"; where less than 90 degrees it is called "*in square* or *under bevel*."

BEVEL BAND-SAW—a band saw designed to saw bevel frames, sometimes called a ship's saw.

BEVELLING-BOARD—a board on which the different bevels or angles of the face or edge of a timber frame or plank are marked, used in laying off the bevel on a timber or plank to be shaped. (See text description of "taking spiling." Pages 50, 51).

BIGHT—to make fast or secure the ends of a rope or hawser to the edge of a sail, gaff, yard or mast; a loop in a rope.

BILGE—the rounded part of the hull between the side and bottom, either inside or outside of the hull; bilge ceiling; bilge-planking.

BILGE CHOCK—a timber fitted in between the frames at the bilges. A 2" space is allowed between the chock and the inside face of the planking for air ventilation.

BILGE DIAGONAL—a line representing the shape of a vessel's hull, drawn on an oblique longitudinal plane from the center line of the vessel to the turn of the bilge on the midship frame.

BILGE KEEL (KEELSON)—a fore-and-aft timber rib, fitted to the outside of the hull at the round of the bilge, used to prevent excessive rolling of the vessel in a heavy sea.

BILGE-LOG—a term sometimes applied to one of the parallel timbers forming the launching cradle, sliding or traveling ways.

BILGES—the lowest portion of the vessel inside the hull.

BILGE-STRAKE—a strake of outside planking at the vessel's bilge.

BILGE-WATER—water that collects in the bilge of a ship, generally foul water.

BINNACLE—the stand or case which supports or carries the compass.

BINNACLE HOOD—the canvas or metal hood which covers and protects the compass.

BINNACLE LAMP—the small lamp attached to the side of the binnacle hood, used at night to illuminate the compass.

BINOCULARS (MARINE GLASSES)—a light parallel double telescope specially fitted for use at sea.

BITT—a wood auger used to bore holes in wood.

BITT OR BOLLARD—the heavy steel or iron castings fitted and fastened down to the deck; large heavy timbers let in through the deck and properly braced below the deck; bitts are used to secure the towing, mooring lines or hawsers to the vessel's hull.

BLACK STRAKE—the strake of planking above the whale strake.

BLINKER—a small electric flashlamp used by the navigating deck officer, quartermaster or signal boy to signal or communicate with another vessel or to the shore.

BLOW, WASH OR SWASH CHOCKS—blocks of wood set in between the frame spaces underneath the floor of the hold. The chocks are set about two or three inches above the inside of the planking; the purpose of these chocks is to prevent the surging of the water in the bilges when the ship is laboring in a heavy sea. See *Swash Chocks.*

BLUFF BOWED—a vessel having a blunt full or broad forward end.

BOAT—(in the sense when used in connection with wooden shipbuilding) a small open or decked or partially decked vessel, easily handled and propelled by oars or small-powered engines. It may be used to transport a limited amount of cargo or passengers. There are many kinds of boats; the purpose for which a boat is built is indicated by the name given for that type of craft—canal, fishing, life, motor, quarter, row, surf, water, whaleboat, etc.

BOAT DECK—the deck on which the lifeboats are carried and stowed.

BOATSWAIN—a subordinate officer of a vessel, who has general charge of rigging, cargo, etc.; his duty is to handle the crew, under the direction of the mate or other deck officer.

BODY-PLAN—a plan showing the shape of a vessel at transverse and vertical planes, square with the keel at the different frame stations in her length. The decks, rails and knuckles are also indicated on this plan.

BODY-POST—the stern-post, also known as propeller post; when the stern-post is made of more than one piece, the post on the forward side against the deadwood is the body-post.

BOLT—a term referring to a roll of canvas, usually 39 yards in length, regardless of width: an iron rod, sometimes with permanent head at one end, the other end threaded with a nut. Bolts are used for fastening two or more pieces of wood, metal or other things together.

BOLT-ROPE—the rope that reinforces the edge of an awning or sail; this is generally sewed on.

BOOM—a long round or oval spar, pivoted at one end, used for hoisting. A spar used to stretch the foot of a fore-and-aft sail.

BOOM FORESAIL—a triangular fore-and-aft sail, rigged on the foremast, having its foot stretched along a boom.

BOOM IRON—see *Wythe.*

BOOM MAINSAIL—a fore-and-aft triangular sail, rigged on mainmast, having its foot stretched along the boom.

BOOM TACKLE—a double purchase tackle used to guy out a boom. Also known as boom guys, when used on cargo booms.

BOOM TOPPING LIFTS—halyards or ropes leading from the outer end of the boom through a block to the lower masthead, thence down to deck, where they are secured; these ropes are used for topping or lifting up the end of the boom, and when used with a sail, relieve the strain on the throat and peak halyards, particularly when the gaff is used.

BOOT TOPPING—a wooden sheathing laid over planking between light and deep load water-lines; the purpose is to cover any metal boltheads which would be exposed to the wet and dry action, and thus prevent destructive corrosion. When used as a protection from the teredo it is creosoted. The area between load and light water-lines on a ship's side painted another color from that of the bottom or the topsides.

BOSS—a term applied to the swelling in the stern-post at the stern tube, which allows a sufficient thickness of material outside of stern tube to give strength to the stern-post.

BOW—the forward end of a ship.

BOWED—a term used to describe the condition of a yard, boom or mast which has been set up so taut as to spring it.

BOW LIGHT—a white, clear light carried forward on the bow or on the forward side of the lower foremast.

BOW LIGHTHOUSE—towers formerly placed on the forecastle deck near the bow of a vessel. These towers carry and protect the port and starboard sidelights; also known as sidelight castles, sidelight towers. Not fitted on modern vessels.

BOWLINE—a curved line or vertical section of a vessel's bow in profile or sheer; also a rope leading from vessel's bow to wharf or another vessel. This rope secures the forward end or bow of the vessel in position.

BOWLINE—a useful rope knot used by sailors and riggers. It is so made that the rope cannot jam or slip and when tied is perfectly safe.

BOWLINE KNOT—a bowline tied with a loop or bight always made at the end of the rope.

BOWLINE ON A BIGHT—a rope knot; a double bowline.

BOWPORT—a square port cut into the vessel's hull at the bow above the water-line and fitted with a watertight door. This port is used to load or unload long lengths of timber cargo in and out of the hold.

BOWSPRIT—a spar projecting forward of the stem, inclined slightly upward. Not used on modern steamers.

BOXING THE COMPASS—to name the 32 points of the compass in their regular order.

BOXING-IN—a term describing the method of notching heels of the cant timbers into the deadwood.

BOXING OF KEEL AND STEM—the scarph uniting the bottom end of the stem to the forward end of the vessel.

BRACE—a term sometimes applied to the rudder gudgeons.

BRAKE—a lever used for operating a deck pump; the lever sometimes used for operating a windlass by hand.

BREAD-BARGE—a box in which to store the ship's bread.

BREADTH—when referring to a vessel, it is a term indicating a measure of distance from side to side. Width as distinguished from length, height or thickness.

BREAK BULK—to start to unload the cargo.

BREAKER (BEAKER)—a small cask used to carry or store fresh water.

BREAMING—to burn off the marine growth on the bottom of a ship.

BREAST-FAST (BREAST-LINE)—a hawser or rope used to secure or moor a vessel alongside a wharf or another vessel.

BREAST-HOOK—the knee at the forward end of the vessel attaching the apron to the shelves, riders or champs.

BREECH—the outer angle of a knee timber; also the becket end of a tackle-block, to which the standing part of a tackle is attached.

BRIDGE—an observation platform or partial deck from side to side of a vessel, generally located amidships, from which the officer of the deck or pilot maneuvers the vessel. The nautical, navigating instruments and chart house are generally kept or located near the bridge. The bridge is protected with screens and weather curtains and generally has an awning overhead to protect the men in tropical weather.

BRIDGE DECK—the deck directly back of the bridge, and generally level or nearly level with it.

BRIDLE—a rope secured at both ends in such a way that the middle forms a bight through which the tackle or hoisting rope is attached. The purpose of a bridle is to equalize the strain on each end of the rope, when taking a strain on two objects or on one long object at two different points.

BRINGING UP (BRINGING TO)—to bring a vessel up to the wind or in the eye of the wind.

BROADSIDE—the flat middle portion of a vessel's side, above water-line.

BROAD STRAKE—the second or third strake of heavy planking from the keel next to the garboard strake.

BUFFALO—the bulwarks extending above the forecastle deck at each side of the stem in the extreme bow.

BUILDING-SLIP—the fitting-out place where a vessel is completed after launching; this is generally a recess or pocket in the foreshore, or the bank of a river, harbor or bay; also the building ways on which a vessel's hull is constructed prior to launching.

BUILT-UP (ASSEMBLED)—several timbers built in together.

BULKHEAD—a vertical partition corresponding to the wall of a building extending athwartships or fore-and-aft.

BULL'S-EYE (A DEADEYE)—a wooden fair lead or pulley, without sheave; a small thin round piece of hardwood having a score around it, in which is fitted the supporting strops or gromet, and provided with one or more smooth holes in the thin part through which to reeve lanyards or ropes.

BULWARK—the ship's side above a deck, applied only when there is no deck directly above; the top sides of a vessel which extend above the deck, like a fence.

BULWARK NETTING—a netting of ratline attached on bulwark stanchions, generally made in a diamond shape, seized at intersections and used in place of bulwarks.

BUNK—a bed or berth in a ship's cabin, steerage, forecastle, passengers' or crew's quarters; a shelf used as a sleeping place on board a vessel.

BUNKER—a compartment in a vessel used for the storage of coal or other fuel.

BUOYANCY—ability to float, or the difference between the weight of a vessel and the upward force of the water that may be displaced.

BURGEE—a small pennant or house flag.

BURTHEN (BURDEN)—the carrying capacity of a vessel; also the weight of cargo, as "a ship of 1,500 tons burden."

BURTON—a type of rope tackle giving great purchase power, sometimes called a single Spanish burton or double Spanish burton. Single burtons are rigged with three single blocks; double burtons are rigged with three double blocks.

BUSH (BUSHING)—a special metal sleeve pressed into the hub of a sheave for a tackle-block; this sleeve is of special wear-resisting and lubricating metal and results in the minimum amount of friction on the sheave-pin.

BUTTOCK—a buttock is similar to a bowline, a continuation of it, but applying to that portion of a vessel abaft the midship frame; that part of a ship's under surface forward of the stern.

C

CABIN—that part of a vessel in which officers or passengers live or have quarters. A room for an officer or passenger.

CABLE—a rope or chain attached to the anchor; a term applied to a wire rope. "Wire cable," a term applied to a dimension of length equaling 120 fathoms, or 720 feet, "a cable length."

CABLE-TIER—the room, compartment or location on a ship where cable is stowed; the chain locker.

CABOOSE—the house on the deck where the galley is located. The house where the cooking is done.

CALKER (CAULKER)—an artisan or man who makes the seam in the deck or planking on ship's side water-tight, either wood or metal.

CALKING (CAULKING)—in wood shipbuilding the process of spreading apart the seams between two planks and filling them with cotton or oakum, and forcing it in tight with a wooden mallet or beetle and special calking tools. This process makes these seams water-tight. In metal the process of calking is done in the following manner: upsetting or turning the inner edge of the outside sheet of metal against the outside face of the inside sheet of metal, using special calking tools, thus making the joint water-tight.

CALK SEAM (CAULK SEAM)—the seam formed by the joint between two timbers, planks, etc., which have been specially prepared to receive the calking. To make a calk seam the planks must be slightly beveled about 1/16″ for each 1″ depth of seam.

CAMBER—the athwartship curvature of a deck; a term signifying the fore-and-aft curvature of a keel, sometimes called "round-up," usually a true arc of a circle.

CANT—a term indicating that a thing has an inclination from a horizontal line; a sloping, slanting or tilted position.

CANT-FRAME—a frame not square, or at 90 degrees to the line of keel.

CANT-HOOK—a wooden lever with an iron hook hinged near one end. Used for canting or turning over heavy logs or timber.

CANT-RIBBANDS—the ribbands that are not square and level or horizontal with the middle line, but are nearly square with the timbers, as the diagonal ribbands.

CANT-TIMBERS—fore-and-aft timbers, whose planes are not square with or perpendicular to the keel or middle line of a vessel.

CANVAS—the woven material from which awnings, sails, etc., used on a vessel, are made. The material is generally cotton duck of varying weight.

CAPS—the long timbers or stringers laid across the top of piles in a wharf or shipbuilding way, the upper block of oak forming the top of the keel block. The keel is laid on the cap or top block of the keel blocks when starting the construction of a ship.

CAP-SCUTTLE—a small hatch framing, composed of coamings and head ledges, raised above the deck, similar to the regular hatch coaming. The top edge of coaming is rabbeted to receive a hatch cover.

CAPSIZE—to upset or overturn.

CAPSTAN—a revolving mechanical device used for heaving in hawsers, cables and anchor chains.

CARGO—the freight carried by a vessel.

CARGO BOOM—a heavy round or oval spar, generally attached near the foot of a mast. Fitted with a topping lift, guy lines and suitable cargo-blocks attached to the outer end. This device is used for hoisting cargo in and out of vessel's hold.

CARLING—a fore-and-aft timber at the side of a hatch, extending across and supporting the ends of short beams and decks, where cut to form a hatchway. All fore-and-aft deck supporting beams or members are called "carlings."

CARRICK-BEND—a type of rope knot, used for joining or securing two hawsers together.

CARRICK-BITTS—the bitts which are sometimes located forward near the windlass; sometimes called "towing-bitts."

CAT-BLOCK—a double or triple block, part of the tackle used in catting or stowing the anchor.

CAT-CRANE—an iron or steel overhanging davit, used in catting or stowing the anchor.

CAT-HEAD—horizontal timbers projecting from the vessel's bow and to which the anchor is raised and secured after it has been hove in. Not generally used on wooden steamships.

CAT-HOOK—a large hook fitted on the strop of the cat-block, which is hooked into the anchor-ring when catting, raising or securing the anchor, after it has been hove in.

CAT OR CATTING-TACKLE—the tackle used to cat or fish the anchor.

CATTING THE ANCHOR—see *Fish the Anchor.*

CAVIL—a long cleat made of timber which is bolted fore-and-aft to the inside face of two or more bulwark stanchions. Heavy ropes and hawsers are belayed or attached to this device.

CAVIL CHOCK—a wooden mooring ring or chock made by packing in solid with hardwood between the timber heads and cutting or fitting a mooring ring chock into the packing or through the planking of the bulwark rail.

CAVIL HEADS—the heads or tops of frames when they are used as cavils or bitts.

CEILING—the inside planking or skin of a vessel, attached to the inside face of the frame, between the center keelson and the upper deckbeams.

CENTER LINE—the middle or axis line of the ship from stem to stern.

CENTER OF BUOYANCY (CENTER OF DISPLACEMENT, CENTER OF IMMERSION)—the center of gravity of the water displaced by the immersed portion of the hull. This is determined solely by the shape of the under-water portion of the hull or wetted surface.

CENTER OF GRAVITY (CENTER OF MASS)—in the case of a body or a system of bodies, as in a vessel with its machinery, stores, cargo, etc., the theoretical point about which all the parts or bodies exactly balance each other, which being supported, the body or bodies as a whole system will remain at rest or in balance in any position.

CHAFING-GEAR—mousing or marlin, rope, canvas, leather, etc., placed upon standing, rigging and spars, to save them from being badly chafed or worn.

CHAIN—a chain is composed of welded links of iron or steel, which are connected together so as to form one unbroken line. On board vessels it usually refers to the heavy chain attached to the anchor, although chains are also used at the lower ends of stays, or on blocks and cargo booms, and in other places where it is desirable to secure a strong, flexible metal attachment. Anchor chains or cables are generally made with stud-link chain.

CHAIN-BOLT—a bolt generally threaded on one end with an eye on the other; the eye is generally forged around the end link of the chain. This bolt is used to make a permanent attachment of the end of a chain to some part of the vessel.

CHAIN-HOOK—a small iron or steel rod with one end forged into a hook, the other end forged to form a handle. This hook is used to stow the anchor chain neatly in the chain-locker or on the deck.

CHAIN-LOCKER—a compartment forward under the forecastle deck in the lower portion of the vessel in which anchor chains are stowed. This is generally located forward of the fore peak-tank.

CHAIN-PIPE—the iron bushing of a deck hole through which the anchor chain passes. The chain-pipe leads from the deck to the chain-locker. This is sometimes a wooden box.

CHAIN-PLATES—iron plates or straps attached to the outside topside planking of a vessel, to which the shrouds or ropes that guy the masts are secured.

CHAIN-STOPPER—an iron toggle that stops and secures the anchor or cable from paying out through the hawse-pipes.

CHALK LINE—a cord covered with chalk; when drawn taut is used for marking a straight line.

CHAMFERING—a small bevel edge worked on to a sharp edge of a plank or timber. Chamfering is used to prevent splintering of the edge of a timber where subject to excessive wear.

CHANNELS—a term applied to that point on a vessel's side where the shrouds are attached.

CHANNEL-WALES—thick strakes of planking worked into the side to reinforce and strengthen the ship where shrouds are attached.

CHART HOUSE—a small room near the bridge used by the navigating officer for charts and navigating instruments.

CHEEK-BLOCKS—the half shell of a tackle-block, which is bolted to the side of a spar or timber and contains a sheave.

CHEEK-PLATES—the heavy metal plates fastened at the sides of the propeller boss on the stern-post. This plate is generally large enough to cover the hood ends of the planking terminating in the rabbet on the stern-post and also the several parts composing the stern-post at the boss.

CHEEKS—the wooden or metal sides of a sheave or tackle-block.

CHESTRESS—piece of hardwood bolted to any part of a vessel containing a sheave; not used on modern steamships.

CHINE—the thick raised part of the timber waterways.

CHINSE—to chinse is to calk lightly with a knife or chisel, seams that will not stand the force required to calk in the usual manner.

CHOCK—a heavy piece of metal or wood fastened to a vessel's deck or to a wharf, or to a similar thing, having jaws between which a rope or cable may be passed, or which may serve as a guide; also a block or wedge of wood or other material used to prevent the limit of motion of a thing; to form a support or to fill a cavity, as by wedging under a wheel, under a timber, or a bilge of a barrel; the support for the ship's boats when stowed on deck. These are usually wooden plank frames sawed to fit the contour of the hull of the ship's boat.

CHUCK—a tool used on a revolving arbor or shaft to hold a tool or drill securely, so that it will revolve with the chuck. A device used to hold augers or reamers to a revolving arbor or shaft of an air-drill, or electric-drill.

CLAMP OR CLAMPS—a heavy strake of timber or timbers fastened to the inside face of the frames under and supporting the shelves; heavy parallel timbers gained and clamped onto the head of a wharf pile or another timber and bolted securely into position; a mechanical device for forcing or compressing timbers or other things together into place, holding or bending together two or more parts, until they can be fastened or secured.

CLAW-STOPPER—see *Chain-Stopper.*

CLEAN—a descriptive term used to indicate the acuteness of a vessel's bow or stern—"she has a clean stern or run."

CLEAT—a wooden or metal fitting attached to the deck, bulwark, house, mast, boom, etc., having arms or projections, by which a rope or line may be secured.

CLEW—see *Clue.*

CLEW-GARNET—see *Clue-Garnet.*

CLINCHING (CLENCHING)—the process of expanding or riveting the point of a bolt or metal fastening over a ring by striking it sharply with a round-nosed hammer or top maul.

CLINCH RINGS (CLENCH RINGS)—a ring of iron or steel over which the ends of bolts or metal fastenings are expanded.

CLUE—the corner of a square sail or awning; also the after lower corner of a fore-and-aft sail.

CLUE-GARNET—the rope by which the clues are secured to the boom, yard or awning stanchion.

COAKING—a method of joining two pieces of timber, such as attaching beams or knees together with coaks or tenons, the purpose being to unite them solidly, so they will not pull or slip apart.

COAL PORTS—the opening or large hole in the vessel's side above the water-line used for receiving coal into the bunkers.

COAMING—the top of the raised boundary of a hatch, scuttle or skylight; in wooden ships generally made of hard, tough timber. The coaming is usually rabbeted at the top inside edge, to receive the hatch covers.

COLLAR—the strap or gromet used to seize a deadeye; also the eye end of a shroud of the standing rigging that slips over the masthead.

COLLISION BULKHEAD—a strong partition built athwartships across the hull near the stem or bow of a vessel and usually used to prevent the water flooding the forward compartments of the vessel if the bow is stove in.

COMPANION—a protection or hood over the ladder leading through a hatch or opening to the lower deck. Its purpose is to keep the rain and spray from beating down the hatchway.

COMPANIONWAY—the passageway or stairway leading from one deck to another.

COMPARTMENT—a sub-division of space in the interior of a vessel; a room in a vessel.

COMPASS—an instrument used on board ship to indicate the magnetic meridian, magnetic north or the direction of objects with reference to the magnetic meridian. Mariner's or ship's compass consists of three parts, viz.: the bowl, the card and the needle. The bowl, which holds the card and the needle, is usually a hemispherical brass receptacle, suspended by a concentric brass ring, called gimbal ring, with pivot or trunnions set at 90°. This gimbal supports the bowl in such a manner that notwithstanding the pitching or rolling of the ship in any direction, the top of the bowl is kept in a horizontal position. The circular card is divided into 32 equal parts by lines drawn from the center to the circumference. These 32 parts are called the "points of the compass." The interval between the "points of the compass" is also divided into quarters and halves, so that the entire circumference of the circle is divided into 128 equal parts. In the whole circumference of 360° the angle between any two adjoining points of the compass is 11° 15′. The four principal divisions are North, East, South and West and are called the cardinal points. The names of the others are compounded of these, and if the direction or bearing referred to lies between any two points, quarter or half points are added, as Northeast by East half East. Points of the compass are as follows: North, North by East, North Northeast, Northeast by North, Northeast, Northeast by East, East Northeast, East by North, East, East by South, East Southeast, Southeast by East, Southeast, Southeast by South, South Southeast, South by East, South, South by West, South Southwest, Southwest by South, Southwest, Southwest by West, West Southwest, West by South, West, West by North, West Northwest, Northwest by West, Northwest, Northwest by North, North Northwest, North by West.

COMPASS TIMBERS—the timbers which are curved or arch-shaped.

COMPOSITE SHIP OR VESSEL—a vessel constructed partially of steel and partially of wood, the stem, stern, keel, frames, etc., being of fabricated steel and the planking and ceiling being of wood.

COMPRESSED AIR—air compressed by mechanical force into a state of more or less increased density. The power obtained by the expansion of greatly compressed air in a cylinder, on being released, is used in many applications in and around a shipyard, as a substitute for that of steam or any other force, as in the operation of airdrills, hammers, small saws, etc.

COMPRESSOR—the friction brake on a windlass; the machine used to compress air.

CONCLUDING-LINE—the small rope forming part of the rope structure of a Jacob's ladder.

CONVERSION—the process of moulding planking and timber with the least possible waste.

COPING—the method of turning the ends of iron lodging-knees so as to hook into beams.

COPPERSMITH—a man who fits or installs copper pipes and fittings. His work differs from that of the plumber and pipefitter in that he must make large pieces of pipe and bends and also form large special pieces, such as condenser heads, exhaust connections from sheet copper, etc. He must be artisan enough to do dovetailing, brazing and flanging.

CORDAGE—a term which is applied in a broad way to all standing and running rigging made of vegetable fibre, such as manila, hemp or sisal.

CORNER LOG—a timber inserted in the corner where planking and shelves meet, also used at the angle where bulkhead and ceiling or deck join.

COUNTER OR QUARTER—a portion of the stern structure, consisting of several parts, the lower counter being the arched part of the stern directly above the wing transom. Above the lower counter is the second counter, the upper part of which forms the lower part of the lights or windows. Counters are generally parted by rails—the lower counter springs from the tuck-rail and terminates at the upper part of the lower counter-rail. The second or upper counter terminates on the upper rail, which is directly under the lights or windows. Also the after overhang of the stern of a vessel.

COUNTER-RAIL—the rail, sometimes ornamented, across a vessel's stern, on which the lower or second counter terminates.

COUNTERSINK (COUNTERSUNK)—the tapered enlargement of a hole to receive the taper of a flush-headed rivet or bolt.

COUNTER-TIMBERS—the extreme after timbers which form the stern and support the counter.

COVE—the concave or grooved molding sunk in the edge of the plank.

CRAB—a small hand capstan or winch.

CRADLE—the wooden frame fitted and placed under a vessel, forming a sled on which the vessel's weight is carried when the vessel rides down the ways into the water during launching operation.

CRANK—a term applied to vessels that are topheavy, a condition generally caused by improper designing or stowing of the cargo.

CRIBBING (GRIDIRON, BUTTRESS BLOCKING)—several tiers of blocks or wood timbers laid parallel, in which each tier of blocks is set at right angles to the one below.

CRINGLE—see *Luff-Cringle.*

CROAKY—a term applied to a plank much curved, twisted or with much sny.

CROSS CHOCKS—short pieces of timber fayed across the deadwood, and fastened to the half or cant frames, to strengthen the weakness of the frames where they are fastened to the deadwood.

CROSS PIECE—a piece of timber framed across the two horns of a bitt.

CROSS SPALLS (SPAULS, SPALES)—a temporary transverse wooden brace used to hold the two horns of a frame to their exact breadth during construction, before the hold-beams, ceiling or planking have been built into the hull.

CROWFOOT—a number of small lanyards or lines which support an awning. These lines are sometimes spliced in or bent on to thimbles on the awning backbone.

CROW'S-NEST—a basket or platform near the top of a mast of sufficient size to hold one or two men. This device is protected with weather curtains or screens to protect the men as much as possible in heavy weather. The weather curtains or screens are fitted with pockets in which are kept the lookouts' oilskins, sou'westers, binoculars or marine glasses. A crow's-nest is used as a station for the lookouts. During war times, most ships have a crow's-nest on at least two masts, which are occupied by lookouts all the time while passing through the danger zone. On some ships the crow's-nest is connected with the bridge by a telephone or a speaking tube. They also have electric connections for alarm bells which are located in different parts of the vessel, to alarm the crew and call them to quarters if there is danger of a torpedo attack.

CRUTCH—a post, saddle piece or stanchion secured to the deck and forked at the upper end, to receive and form a rest for the outer end of a spar or boom when not in use.

CUCKHOLD NECK—a rope knot, by which a rope is secured to a spar; this knot is so made that the two parts cross underneath the bight and are seized together.

CUP—a solid piece of iron let into the capstan step in which the lower end of the shaft or spindle of the capstan is held in position.

CUT SPLICES—a term applied to a rope splice. It is made of one short and one long length of rope. The short length has both its ends spliced into the bight of the long length, thus forming a kind of eye-splice.

CUTTING-DOWN-LINE—the elliptical curved line representing the upper side of the floor timbers at the middle line of a vessel. This line is the same to the frames as the bearding-line is to planking.

CUTWATER—the timber bolted on the forward side of the stem, extending from the top of the stem down to the gripe or to the keel when no gripe is used.

D

DAGGER—a piece of timber that faces into the poppets of a cradle or launching way, and crosses diagonally under the keel at the bow, holding the two parallel timbers of the launching cradle from spreading. NOTE: the word "dagger" seems to apply to any timber, plank or knee which is framed in aslant or diagonally.

DAGGER KNEES—are used in place of hanging knees. The arm against the side of the vessel is brought up aslant to the under side of the connecting beam. In merchant ships they are used in the lower hold, and are placed in this position to allow as much storage room as possible. NOTE: Any straight hanging knees not perpendicular to the face of the beam to which they are attached are generally called "dagger knees."

DAP—shallow groove cut in the face of a timber; groove cut in the outside face of the vessel's frame, to receive or hold steel strapping.

DASHER OR DRIVER BLOCK—a small block attached to the end of the after gaff or spanker gaff, used for reeving the ensign halyards. Most steamers do not carry this after or spanker gaff.

DAVIT GUY—a small guy rope secured to the extreme outer end of a davit, used to secure the davit in a desired position, generally at a right angle to the keel.

DAVITS—the fixed wooden timbers, iron or steel forgings which can be swung or topped over the side of a vessel, and from which life or other boats are suspended; a small frame used for catting the anchor, handling accommodation ladder or hoisting ammunition from the magazine; "boat davit," "cargo davit," "accommodation ladder davit," "magazine davit."

DEADEYE—a small circular hardwood block without sheave, containing three or more holes pierced through the least thickness, and with a score or groove cut around the outside of the big circumference to receive a strop or grummet. It was formerly part of the rigging used for securing the shrouds to the chain-plates and setting shrouds taut. Turnbuckles have now generally replaced deadeyes for this work.

DEAD-FLAT—the middle of the length of a ship where the frames are similar with flat floors, sometimes called the "square body." From the first dead-flat frame forward to the last dead-flat frame aft they are sometimes marked by the framer thus: ⊠

DEAD-LIGHT—thick glass windows fitted in the portholes of a vessel.

DEAD-RISE—the inclination or angle that the bottom of a vessel makes from the horizontal, measured from the horizontal at the half or molded breadth.

DEAD-ROPE—a rope that is securely fastened at each end and does not reeve through any block or pass over any sheave.

DEAD-WATER—the eddy to be seen in the water under the stern when a ship is moving forward.

DEAD-WEIGHT CAPACITY (DEAD-WEIGHT CARGO, DEAD-WEIGHT TONNAGE)—the total displacement of a ship represents the weight actually supported by the water, and may be divided into two sections: Section 1 is the light-weight of the ship. Section 2 is the dead-weight tonnage.

Section 1 may be divided into two parts, viz.: hull, which consists of steel, wood and fittings; machinery, which consists of engines, boilers and auxiliaries.

The dead-weight capacity, therefore, consists of cargo, spare gear, crew and effects, passengers, baggage, coal in bunkers, coal on fire bars, fresh water, reserve feed water, provisions, sanitary salt water, water ballast, bilge water, stores, etc.

As the ordinary expression for dead-weight includes coal, feed water, consumable stores, the length of a voyage and the quantity of these items necessary for that voyage will have a material effect on the total amount of cargo the vessel can carry, so that sometimes dead-weight cargo is spoken of as a more definite indication of the actual earning capacity of the vessel.

The dead-weight cargo capacity is the capacity of the vessel when fully loaded and provided with all fuel, etc., for actual cargo-carrying.

DEAD-WOOD—a mass of timber built up on the keel at the bow and stern of a ship. The dead-wood supports the cant-frames, bracing and stiffening the stem and stern-posts.

DECK—the part of the vessel corresponding to the floor of a building.

DECK-BEAM—a member running athwartship under and supporting a deck.

DECK BULL'S-EYE—dead-lights; the thick pieces of glass fitted flush and watertight into the deck to allow light in the hold or compartment.

DECK ERECTION—the cabins, houses or superstructure, as erected above the upper deck.

DECK-PIPE—a term usually applied to the hole in the deck through which the anchor chain or cable leads from the chain-locker to the windlass.

DECK-TACKLE—a double purchase used for handling heavy weights or cargo on deck.

DEPTH OF HOLD (DEPTH IN HOLD)—the vertical height between the floor and main deck; the upper deck in Ferris type of ship.

DERRICK—a mechanical device for hoisting heavy weights, cargo, etc.

DEVIL'S CLAW—a strong forked iron or steel hook to secure or "stopper" the anchor chain or cable, also called "chain stopper."

DIMINISHING-POST—a tapering piece of plank, or timber, used to terminate the end of a strake which is not continuous from bow to stern, or used for some other similar purpose.

DISPLACEMENT—the amount of water displaced by a vessel. If the vessel is floating in still water, the weight of the water she displaces equals the weight of the vessel herself with all her machinery, equipment, stores, cargo, etc.

The displacement of the vessel in cubic feet divided by 35 when floating in salt water, or by 36 when floating in fresh water, will give the total weight of the vessel, etc., in long tons of 2240 lbs.

DOG—a wooden or metal fitting used to secure doors, hatch covers, manhole covers, etc.; a wide iron or steel staple used by shipwrights.

DOG-SHORE—a small wooden brace or strut used for supporting the ship on the building ways until she is ready to launch.

DOLLY—a short iron or steel pin, temporarily driven into holes bored into the frame, planking or ceiling, used to brace jacks or other mechanical levers when forcing timbers or planks into position; a short, heavy bar of steel used to buck up rivets when riveting in place; a roller put under heavy objects in order to move them with little labor from place to place.

DOLLY-ROLLER—a small roller mounted on a wooden or metal frame and used to transport timber or heavy material from place to place.

DOPE—a term applied to a mixture of red lead and tallow, used for gunning a seam or crevice that develops or threatens to develop a leak.

DOUBLE ASSISTANT KEELSON—the keelson timbers which are alongside the outside and are fastened to the assistant keelson.

DOUBLE BLOCK—a tackle-block that contains two sheaves.

DOUBLE BOTTOM—the compartment at the bottom of a steel or composite ship under the floor between frames and the ceiling and planking, or inner and outer bottoms. Used for ballast, tanks, storage of water, fuel, oil, etc.

DOUBLING—planking a ship's bottom twice; sometimes done when ships are weak or when planking cannot be secured of sufficient thickness.

DOWEL—a short, round peg of wood, used for joining or securing two timbers, or planks, or other objects together.

DOWELLING—a method of joining two pieces together by tenants, dowels or coaking.

DOWNHAUL—a line attached to a fall, whip, purchase tackle, halyard, etc., which will not overhaul or lower of its own weight.

DRAFT (DRAUGHT)—the depth to which a vessel sinks in water, especially when laden; the vertical distance from the bottom of the keel to the surface of the water. When a vessel is loaded, the term "loaded water draft" is used; when unloaded, the term "light water draft" is used. Also the drawing or design of the ship prepared by the naval architect, indicating the different parts and dimensions of the ship. From this drawing the ship is constructed.

DRAFT-MARKS—the marks cut or inscribed on the stern and rudder post which indicate the depth or distance from the bottom of each mark to the bottom of the keel. The inscribed marks are usually six inches high. By reading the height of the water on these marks you can determine the amount of water or draft that the vessel has.

DRIFT—a term applied to indicate where sheer is raised and rails cut off; the scroll pieces with which rails are sometimes ended, sometimes called "drift pieces"; the difference between the diameter of a mast and its hoop, or between the diameter of a hole and the treenail or bolt which is used; the length of a rope which is more than the part used; the amount of space between the two blocks in a purchase tackle.

DRIFT-PIN—a bolt used for backing out short or broken treenails or bolts.

DRIVER—the foremost fore-and-aft spur of the cradle, launching or bilge ways, the end of which is attached to the forward side of the bow poppet and is cleated or bolted to the ground ways.

DRUMHEAD—the top part of a capstan, formerly made of a semicircular piece of elm which framed together forming a circle, into which the capstan bars were fixed.

DRUXY (DRUXEY)—a term indicating a certain state of decay in timber. When observed generally shows white, spongy veins. One of the most deceptive of all defects.

DUBBING—the process of dressing the timbers or planking smooth with an adz.

DUMB-CHALDER—a metal cleat or block, bolted to the afterside of a rudder-post, for the end of a rudder pintle to rest on. Its purpose is to relieve the gudgeon or rudder-braces of some of the weight of the rudder. In modern vessels the weight is carried by a rudder bearer.

DUMP—a nail used in fastening planking to a timber frame, as distinguished from a bolt.

DUNNAGE—light material such as mats, thin boards or brushwood, stowed among or beneath the cargo of a vessel, to keep it from injury by chafing or to make the stowing compact, so the cargo will not shift in heavy weather when the vessel is rolling or pitching badly; any light or less valuable articles of cargo used for the same purpose. In shipbuilding waste or refuse wood is sometimes called "dunnage."

DUTCHMAN—a piece of wood fitted into an imperfectly made seam; a shim.

E

EDGE BOLT—to fasten the timbers together through the edge or narrow face.

EDGE SET—the distance a plank is to be forced edgewise.

EDGING OF PLANK—sawing or hewing it narrow.

EKING—supplying the deficiency in length of a piece of planking or timber by scarfing or butting; a filling-out piece.

ELEVATION—when applied to shipbuilding the perpendicular plan or longitudinal section of a vessel on which the heights and lengths are indicated; sometimes called the sheer draught.

ELLIOTT EYE—an eye spliced in on a hawser that contains a hawser.

ELLIPTICAL STERN—an oval-shaped stern.

ENSIGN HALYARDS—the small ropes or halyards by which the ensign is hoisted, whether the ensign is shown at the stern, masthead or peak.

ENTRANCE—a term applied to the fore wedge-shaped underpart of the vessel, indicating the vessel has easy lines: "she has a fine entrance."

ERECTION—the process of hoisting into place and bolting up the various parts of the vessel's hull, machinery, etc.

EUPHROE—a small piece of wood having several parallel holes and used to spread the ropes or legs of an awning's crowfoot.

EVEN KEEL—the vessel is said to be on "even keel" when the keel is level or parallel to the surface of the water; also when she has no inclination to list to either port or starboard.

EYE OR EYES—a spliced loop in the end of rope, hawser, line or wire rope cable; the hole in the top part of the anchor shank through which the anchor ring passes; a loop forged on the end of a bolt or bar of steel or iron "eyebolt." The same term applies to the hawse holes in the bow of a vessel; "up in the eyes," refers to the extreme bow of the vessel either above or below decks.

EYEBOLT—a bolt formed with an eye or forged ring at the end.

EYELET HOLES—small holes worked into a sail, reinforced by sewing or with metal grummets; through these holes the lanyards or lashings for spreading or securing an awning are passed or rove.

F

FACE PIECES—wood pieces worked on the flat part of a knee.

FACING—the process of attaching one piece of timber to another with a rabbet; the purpose is to build up and strengthen.

FAIR—smooth without abruptness or unevenness; "fairing the lines" is the process of making them smooth or with a uniform curve without hollows or bumps.

FAIRLEAD (FAIRLEADER)—a fitting, either wood or metal, through which a rope, line, etc., may be led, so as to change its direction slightly, without excessive friction.

FAIRNESS—when the buttocks, bow and sheer line in the profile, or level deck, knuckles and boundary line in the half breadth, and the frame stations in the body show a continuous easy curve, without abruptness, all lines coincide, the hull is said to be fair, or show fairness.

FAIR SHIP—to keep a ship square upon the shipbuilding ways during construction.

FALL—the hauling end of a rope or part of the tackle on which the pulling power is applied.

FALLING HOME OR TUMBLING HOME—the narrowing of a deck across a vessel's beam; the inward inclination from the perpendicular which the top sides of a vessel have above the water lines.

FALSE KEEL OR SHOE—lower or second keel composed of oak, elm or other hardwood fayed and securely fastened directly under the main keel, to prevent injury to the main keel in case the vessel should ground or strike the bottom.

FALSE RAIL (SPRAY BOARD, BUFFALO)—a timber rail fayed upon the upper side of the main or upper rail of the head. Its purpose is to form a seat of ease and to strengthen the head rail next to the stem at the bow.

FASHION PIECES—timbers so called because they fashion the fantail and the slope of the stern at the after part of the ship; they are usually framed to the ends of the transom, deadwood and horn timbers.

FAST SECURE (MOORING ROPE, HAWSER, LINE)—a rope to secure a vessel to the wharf.

FASTENINGS—nails, bolts, dowels, treenails, etc., used to secure the planks, timbers and framing of a vessel together. There are many kinds of fastenings; some of them are as follows: Single, double, double and single, external, inside, dump, taper, two drift, through fastening, etc.

FATHOM—a measure of length or depth equivalent to six linear feet.

FAY (FAYED, FAYING)—the process of joining and fitting together accurately one piece of timber or planking to another.

FELT—a matted fibrous material which is produced in sheets and which is generally impregnated with coal tar, creosote or some similar product or preservative and is used between the over sheathing and planking to prevent and to protect the planking from the attacks of the teredo and other destructive seaworms.

FENDER—a fitting, cushion device or spar, to prevent damage to the ship's hull at or near the water line, by another vessel, floating objects, docks, etc.

FID (KEY)—a block of wood or iron used to support a topmast or top-gallant mast, by placing it through the fid hole in the heel of the mast, like a key, to allow it to rest on the trestle trees; also a conical pointed piece of hardwood like a large marlin spike used for splicing large ropes, opening eyes of rigging, etc.

FIDDLE BLOCK—an elongated shell containing two sheaves in which the larger sheave is generally above the smaller.

FIDLEY—a room or compartment directly over the boilers, through which the uptake pipe or smoke-stack passes. This room is generally the means of ventilation of the boiler compartment. It is not fitted with decks, but has iron gratings instead.

FIDLEY HATCH—the hatch at the top of the fidley around the smoke-stack and uptake.

FIFE-RAIL—the rail surrounding a mast, secured to the mast or deck, arranged with holes in which belaying pins are inserted. Modern vessels are not arranged in this way. Belaying-pins are generally attached to the mast on a spider-band.

FIGUREHEAD—a figure, generally in the form of a woman, which is attached to the upper forward side of the stem; sometimes a coat of arms or a crest is used. Vessels are rarely built with this ornamentation today.

FILLER (DUTCHMAN)—a piece of wood inserted in a made-up mast to cover a defect or to make up a deficiency; a composition used on woodwork to fill the pores of the wood before applying paint.

FINISHING—curved ornamentation on the quarter gallery or the stern quarter; generally below the second counter, and above the upper lights. This decoration is rarely put on vessels now.

FISHING—the act, process or operation of joining two spars together by lashing them.

FISH THE ANCHOR—a term describing the process of securing the anchor in its permanent position or location on the deck of the vessel ready to go to sea; also the process of hoisting the anchor to the anchor davits, and leaving it hanging in that position; called "catting the anchor."

FLAGSTAFF—the flagpole at the stern of a vessel.

FLAIRING (FLARING)—in shipbuilding a frame indicating that the vessel has sides or a bow curving gradually outward from the base; spreading or bulging; the reverse of falling or tumbling home. The upper part of the bow is often made flairing, an easy method of construction which will help to prevent the vessel's bow becoming immersed so deeply when the vessel is pitching badly in heavy weather.

FLAM—similar to flairing.

FLAP—a term applied to a small partial deck built almost level, with either a fore-and-aft or athwartship curvature.

FLATS—a term given to frames or timbers amidships that are not beveled, and are similar to the dead-flat. In framing the character is sometimes put on the timber, indicating that it is dead-flat.

FLEET—the process of spreading apart two blocks of a tackle.

FLEMISH COILS—coiling a rope when starting in the center and working to the outside.

FLITCH—the wide timbers from which frames are sawed. A flitch is generally a slab cut, from bark to bark.

FLOOR—the horizontal portion of a transverse frame extending from the keel or center line of the vessel to the bilge; a term applied to the bottom of the hold on the inside of the vessel.

FLUSH—an even level surface, a flush deck; a deck without bulwarks; level fore-and-aft without interruptions or obstructions.

FLY—see *Vane*.

FOOT-WALING—inside planks or ceiling in a vessel laid over and fastened to floor timbers or frames.

FORE—towards the front or forward side of anything.

FOREBODY—the forward half of a vessel.

FORECASTLE—the forward portion of the hold, generally used for the crew's quarters.

FORECASTLE DECK—the deck over the forecastle at the extreme bow of the vessel.

FORE CHANNEL—the channel on the top sides of the vessel through which the fore shrouds are attached.

FOREFOOT—the corner or angle on the forward outside bottom of the stem where the gripe is fayed to the stem and keel.

FOREHOODS—the end pieces of planking at the bow which terminate at the rabbet and which are fastened to the stem, apron, deadwood, etc.

FORELOCK—a fitted wedge of iron used to secure a bolt in place by being thrust through a hole in the round end of the bolt. It is sometimes slightly bent to prevent becoming detached, a method of fastening similar to the cotter or split pin.

FOREMAST—the forward mast in all vessels having two or more masts. In vessels having only one mast it is called the "mainmast."

FOREPEAK—the compartment in extreme forward part of the vessel's hold under the deck and forecastle, directly in the eyes of the vessel.

FORERAKE—the angle or inclination of a vessel's stem forward at the top.

FORERIGGING—the shrouds and back stays, with the ratlines for the bracing and support of the foremasts.

FORESAIL—the sail on the foremast which is stretched along the boom or yard.

FORE-AND-AFT SAILS—the sails which are nominally carried on a vessel in a fore-and-aft direction. They are triangular or rectangular in shape and are always secured on their forward side to a stay or the mast. All fore-and-aft sails carried forward of the mast are triangular. All fore-and-aft sails abaft the foremast, if carried on the stays or carried on the mast without gaffs, are triangular. If a gaff is used they are rectangular. The foot of a fore-and-aft sail may be used with or without a boom.

FORESHROUDS—same as forerigging.

FORESTAY OR HEADSTAY—the hemp or wire ropes leading from the stem to the head of the mast or hounds. This is to stay or brace the mast in a fore-and-aft direction.

FORESTAY SAIL—the head sail forward of the foremast, which is set on the forestay.

FORE-YARD—a yard carried on or supported on the foremast. This might apply to a wireless yard.

FORWARD—near or towards the bow.

FOXEY (FOXY)—see *Druxey*.

FOURFOLD BLOCK—a purchase block having four sheaves.

FOURFOLD PURCHASE—a purchase which has two blocks of four sheaves each.

FRAME—the wooden portion of the hull formed by the stem, stern, rudder-post, keel, keelsons, hold-beams, deck-beams, clamps, waterways, stringers and ribs, to which the skin or shell, ceiling and planking are fastened; a term sometimes applied to one frame or rib of a vessel.

FRAME SPACING—the fore-and-aft distance between the center lines of adjacent frames.

FRAME-TIMBERS—the several timbers composing the frame of a vessel; these may be the floor and futtock-timbers. The number of timbers in a frame depends upon the design of the vessel and the position of the frame in the vessel.

FRAMING—the supporting and stiffening structure of a vessel over which the planking, ceiling and decks are fastened. It usually consists of tranverse frames or ribs, beams, floors, etc., and the longitudinal framing or keel, keelsons, longitudinal stringers, waterways, clamps, etc.

FREEBOARD—the vertical distance from the upper or water-tight deck to the water-line or surface of the water.

FREEING PORT—an opening in the vessel's bulwarks to allow the water to run freely overboard. In heavy or rough water if the sea boards or breaks on the deck, these ports carry off the water quickly.

FURL—the process of rolling up or securing a sail or awning.

FURLING-LINE—small line or lanyard used to secure a sail or awning to the boom, mast or awning backbone after it has been furled. When a furling-line is cut into independent short lengths these pieces are called "stops" or "gaskets."

FURNITURE—a term applied to the rigging, spars, anchors, sails, cables and other fittings of a vessel.

FUTTOCK-BANDS—an iron or steel band encircling the mast just below the top, and to which the futtock-shrouds are attached.

FUTTOCK CHAIN-PLATES—iron or steel chain-plates to which the futtock-shrouds are attached.

FUTTOCKS—the timbers forming a part of a vessel's frame, being an extension of the floor up to and around the bilge to the top-timber. A frame may have several futtocks.

FUTTOCK-SHROUDS—short shrouds or iron rods which extend from the lower end of the futtock chain-plates to the futtock-bands.

FUTTOCK-STAFF—a short length of wood or iron covered with canvas or leather, seized across the topmast rigging in a similar manner to the sheer-pole.

G

GAFF—a spar used along the head of a fore-and-aft sail.

GALLEY—the cook-house or compartment used for preparing and cooking food for the crew and passengers.

GANG—a set of standing rigging is called a "gang rigging."

GANGWAY—a passageway—a ladder or other means of boarding a vessel.

GANTLINE (GIRTLINE)—a single line rove through a temporary single block. A small line sent down from aloft to hoist up tools or material needed.

GARBOARD-STRAKE—the strake of heavy outside planking next to the keel.

GARNET—a purchase tackle or line on the mainstay, used in handling cargo.

GASKETS—short pieces of tape or canvas rope, used for securing a sail—see *Stops*.

GEAR—a term applied to tackle, ropes or blocks, etc., used for hoisting sails, cargo, etc.

GIMBALS—a mechanical device for supporting a compass, so that the surface is always level. In its simplest form it consists of two concentric rings, the outside having pivots or trunnions, by which it is supported at right angles to the pivots or trunnions of the inside ring which it carries. This device keeps the face of the compass level regardless of whether the vessel is pitching or rolling.

GIN POLE—the mast for a light portable hoisting rig, usually fitted with three or four guys and hoisting tackle.

GIRDER TIMBERS—fore-and-aft timbers running continuously from end to end of the vessel directly under the deck-beams, also continuous timber running along the deck each side of the hatch.

GIRTLINE—see *Gantline*.

GOOSENECK—a kind of hook; an iron swivel, forming the fastening between the boom and the mast, consisting of a pintle and eyebolt.

GOOSENECK BAND—an iron or steel band used to secure a gooseneck to a boom.

GRATING DECK—the deck in a magazine used to keep the powder or other ammunition out of the water or free from moisture; generally placed a foot or more above the magazine floor or deck.

GRAVING-PIECE—a piece of wood fitted into a defective place; a dutchman; a filler.

GRIDIRON—a term sometimes applied to the timber cribwork used for various purposes in and around a shipyard, as for instance, the support of the launching-ways where it is impossible to drive piles.

GRIPE—the corner-piece, generally made from a natural timber crook, which joins the stem and the front end of the keel at the forefoot.

GROMMET (GRUMMET)—a ring of rope used for various purposes, made from a single strand of rope, laid three times around its own center part. This makes a continuous ring of rope of any desired size. A metallic eyelet used on sails and flags.

GROSS TONNAGE—is the tonnage measurement of the hull and superstructure with certain allowances and exemptions, as set forth in the regulations and as governed by the laws of the United States. Certain measurements are taken to determine the volume of the different parts of a ship, and with the allowances and exemptions deducted the remaining figure is in cubic feet, which, divided by 100, gives the gross tonnage measurement.

Two other gross tonnage measurements are required on vessels sailing under the flag of the United States: One is the Panama Canal measurement, which is performed in practically the same way, except that the deductions and exemptions are different. This measurement is regulated by the statutes of the United States. The other measurement is the Suez Canal measurement, and is performed in practically the same way except that the deductions and exemptions are slightly different. The method of taking this measurement and the exemptions and deductions are regulated by the Suez Canal Measurement Rules.

GROUND-TACKLE—a term applied to the anchor, cables and hawsers.

GROUNDWAYS—timbers in the ground, under the hull on each side of the keel, and which form the tracks or guides upon which the vessel slides when launched.

GRUMMET—see *Grommet*.

GUDGEON—the fitting on which the rudder swings. The gudgeons fit around the pintles. The pintles and gudgeons combined make a hinge on which the rudder hangs and swings.

GUN-DECK—a covered deck carrying the principal batteries of a vessel of war; in modern cruisers the deck next below the main deck, on which guns are mounted.

GUNNING A SEAM—to force soft tallow and red lead or other similar material into an opening or crack, to stop a leak.

GUN-TACKLE PURCHASE—a purchase tackle which is made up of two single blocks and the required length of rope.

GUNWALE (GUNNEL)—the upper strakes of planking in the bulwarks; boot; the finish or top planking of the sides.

GUY—a rope used to steady and prevent from swinging a frame, mast or other erect object.

H

HALF-BREADTH PLAN—a construction plan of the hull, showing plank sheer line, rail line and all water lines as curves. The ending of all lines in the sheer plan are squared down to their respective planes in the half-breadth plan.

HALF-FRAMES—the forward or aft frames or ribs of a vessel which do not cross the keel. but are bolted to the side of the keel and dead-wood.

HALF-HITCH—a rope knot used by sailors and riggers.

HALF-TIMBERS—the short lower timbers in the cant frames, and which are similar to the lower futtocks in the square body.

HALYARDS (HALLIARDS)—the ropes or tackle used for hoisting or lowering sails, booms and other top gear of a vessel. They carry names indicating their location or use, as deck halyards, throat halyards, ensign halyards, peak halyards, etc.

HAND OR HANDS—a term applied to one or more members of the crew, as "All hands lay aft."

HANG—the downward curve in a vessel's planking.

HANGING BLOCKS—tackle-blocks which are used at the masthead for the halyards or headsails; such as jibs, stay-sails, etc.

HANGING KNEES—the knees which are fastened to the sides of a vessel, one arm of which hangs vertically or nearly vertically.

HARNESS—a term describing the rigging of a vessel.

HARPINS—the curved wooden ribbands or timbers, trimmed and beveled to the shape of the fore-and-aft body of the vessel. Used for holding the fore-and-aft cant frames in position until the ship is ceiled and the waterways, shelves and planks are fastened. This term is sometimes used in describing the bow of a vessel, as lean or full haripn, meaning the bow is sharp or blunt.

HATCH—an opening in the deck through which cargo, coal, etc., is loaded; also an opening in the deck for gangway, ladders, etc.

HATCH BATTENS—the strips of wood or iron used to batten down the hatches or secure the tarpaulin tight over the hatch covers.

HATCH COVERS—the removable planks or covers used to cover or close the hatch or hatchway.

HATCHWAY—same as hatch.

HAULINGLINE (GANTLINE)—a thin or small line lowered or sent down from aloft to haul up material desired.

HAWSE—to drive or calk into a seam with a heavy mallet.

HAWSE-HOLE—a hole in the bow of a vessel through which the anchor chain or cable passes.

HAWSE-PIPE—the tube or hole connecting the forecastle deck with the side of the vessel at the hawse-hole. Through this tube or pipe the anchor chain or cable passes overboard.

HAWSER—a large rope, laid with a left-hand twist, generally made in nine strands. When made of three small ropes made up in one, it is generally called "cable laid" rope or hawser. When made up of four small ropes made up in one, it is called "shroud laid" rope or hawser.

HAWSING-IRON—a calking chisel used to hawse a seam being calked.

HAWSING-MALLET—a calking mallet or beetle.

HEAD—the forward or upper end of anything, more particularly on shipboard applied to all work fitted forward on the stem, as the figurehead, lee rail, the top of a frame; sometimes referred to as the bow of a vessel.

HEAD-CRINGLE—throat-cringle; an iron ring which is spliced into the bolt rope at the junction of the leach and head of a fore-and-aft sail.

HEADLEDGES (HEADLEDGER)—the athwartship piece which frames the hatchway and ladder ways.

HEAD-RAILS—the rails at the head of a vessel which extend back from the figurehead to the cat-head and bow; these are not only ornamental but useful, as they stiffen the figurehead.

HEAD-ROOM—the clear height in any place, as for instance from the top of the deck to the underneath side of the deck beam above.

HEADSAILS (HEAD JIBS)—all sails forward on the foremast. These are generally triangular sails and are carried on the forestays.

HEAD-SHEETS—the sheets or tackle controlling the headsails.

HEAD-YARDS—all yards attached to or carried by the foremast.

HEART—the block of hardwood shaped like a heart with strap or gromet around its big diameter and having a small hole through its least diameter for light lines to be reeved through, similar to a deadeye; the center strand of a four strand rope.

HEAVE-IN—a term signifying the pulling in of a rope.

HEEL—the lower end of a tree, timber, mast, or the inner end of a boom; after end of a ship's keel; the outside angle of a knee; a term applied to a vessel when she is not in an upright position but inclines to port or starboard, due to the pressure of the wind or uneven loading of the cargo or stores.

HEEL-KNEE—the timber, iron or steel knee that unites the stern-post or rudder-post with the keel.

HEEL-PLATES—iron or steel plates riveted to the sides of the keel, stern-post and rudder-post.

HELM (TILLER)—the lever by which the rudder is directed. This device has been replaced in modern steam vessels with a rudder quadrant; a term indicating the direction to which the helm or tiller is to be put, which is opposite that of the rudder. When the rudder is turned to port, the vessel is said to carry a starboard helm, or vice versa.

HITCH—the term applied to a single rope knot or method of fastening a rope line to a spar or other object.

HOGGING (BROKEN-BACKED)—the vessel is said to hog when the amidship part of her keel and bottom have been strained so as to curve or arch upward. This term is opposed to sagging, which is applied in a similar manner, meaning a strain or curvature in the opposite direction, or downward.

HOIST—the length of the luff of a fore-and-aft sail. The distance from the jaws of the boom to the jaws of the gaff when a sail is hoisted. The vertical dimensions of flag measured along the halyards or pole. The distance two tackle-blocks of a purchase tackle are apart. The effective distance that an object can be hoisted, lifted or pulled up with a rope.

HOISTING FALL—a hoisting rope; a rope which is attached to piece of cargo, sail, boom, spar or any other thing by which it is raised or hoisted up from the deck, water, wharf or dock.

HOLD—that part of the vessel which is below the decks, between the bulkheads and is reserved for the stowage of stores, water, ballast and cargo.

HOLD-BEAM—a beam in the hold sometimes used as a support for the 'tween decks; they are similar to deck-beams, but are generally made without crown or camber.

HOOK AND BUTT—a term applied to the mode of fastening timbers together lengthwise by scarfing or laying the ends over each other.

HORN—to line or square up; a frame is horned or squared with the line of the keel by equal measurements from a central point of the keel to similar points on each side of the frame.

HORNS—a term applied to the jaws of a boom.

HORN TIMBERS—large timbers that extend aft on each side of the stern-post and rudder-posts. These timbers form the main support for the overhanging portions of the stern.

HORSESHOES—large straps of iron or copper shaped like horseshoes and let in the stem and gripe on opposite sides. Bolts pass through the timber, and horseshoes thus securely fasten the gripe to the stem.

HOUNDING—the lower part of the mast below the hounds.

HOUNDS—the projection or cheeks which are fayed to the sides of the masthead and which serve as supports to the trestletrees.

HOUSE—a term applied when lowering a topmast, to house the mast; the superstructure above the upper deck of a vessel which contains the cabins, etc.

HOUSING—the housing is that part of a lower mast below the deck.

I

IN-AND-OUT BOLTS—a term applied to those bolts fitted in knee, pointers and riders which are driven through the vessel's sides or athwartship.

INBOARD—the inside of the vessel towards the center line.

INJECTION—a term applied to the opening in the side of a vessel combined with the pipe and valves leading from the ship's sides to the circulating pump, thence into the condenser. Through this opening, valve, pipe and pump, the sea water for the condenser is brought.

INNER JIB—the headsail which is directly forward of the forestay sail.

INNER POST—the oak timber fayed on the foreside of the stern-post for the purpose of seating the transom.

INSIDE PLANKING—the planking on the inside face of the frame, commonly called ceiling.

IRISH PENNANT—the loose end of a rope which hangs over an awning, sail, yard or lies around the deck in a slovenly manner.

J

JACK—a flag showing the canton or union of the national ensign with the fly. In the American flag it would be the blue field without the thirteen red and white stripes. The jack is generally flown from the jack-staff at the bow.

JACK BEAMS—the short deck or head-timbers that do not cross the vessel, as the deck-beams or head-beams at the hatch openings.

JACK-ROPE (JACK-STAY)—the foot of some fore-and-aft sails is secured to the boom or spar by a line known as a jack-rope, running fore-and-aft through eyes which are screwed in the top of a spar, and through small thimbles which are sewed into the bolt-rope along the foot of the sail. These thimbles are generally located where the seam joins the bolt-rope.

JACK-STAFF—the flagpole at the bow of the vessel.

JACOB'S-LADDER—a ladder with rope sides and wooden steps or rungs for climbing the sides of vessels with high bulwarks; a temporary ladder used from the side when it is not practical to lower the accommodation ladder.

JAW-ROPE—a piece of rope or wire passing around the forward side of a mast, the ends attached on the two horns or the jaws of a gaff, boom or spar; hardwood beads are generally strung on this rope or wire and act as rollers to prevent the rope from jamming on the mast when hoisting or lowering the sail.

JAWS—the pieces of natural crooked wood or metal attached to the inner end of a gaff or boom on each side. These jaws fit around the mast and hold the boom or gaff into position; sometimes called "horns."

JEW'S-HARP—a peculiar shaped shackle in the end of a chain or cable, used as a sling, to allow for quick adjustment of length, without knotting the chain.

JIB—a triangular sail carried on the forestay, which is ahead of the foremast.

JIB-STAY (JIB-HEAD)—a fore-and-aft stay on the foremost. In most steamers this runs from near the after side of the stem-post to the lower foremast head or where only lower mast is carried, to the point on the mast where the main shrouds are attached.

JIG—an extra purchase made fast to the end of the throat or peak halyards; the bight of the halyards is rove through the blocks, and the two ends are brought down to the deck, generally one end on each side of the mast. One of these ends is the regular hauling part and the other is a small purchase tackle, enabling the halyards to be easily set up taut; this purchase is called a "jig."

JIGGER—a handy billy or tackle that is used about the deck; a rig similar to a jig on the throat and peak halyards; also a sail set on the jigger-mast.

JIGGER-MAST—aftermost mast on a four-masted vessel; also the small mast carried on the stern of yawl-rigged boats.

JOGGLE—the process of notching a timber to fit over an obstruction or another timber; also used in a general sense when anything is notched to fit over another thing.

JOINER—see *Ship Joiner.*

JUMPER STAYS—the additional stays which lead from the lower mastheads to the top sides of a vessel, used in heavy weather—or when additional bracing is needed for the masts, as when handling heavy cargo, these stays are set up.

K

KEEL—the fore-and-aft construction of heavy timbers scarfed end to end and extending through from the stem-post to the stern; and rudder-post, on the outside of the bottom of a vessel along the center line; the backbone of the ship on which the stem, stern-post, rudder-post, deadwood and frames are erected. The laying of the keel is the first operation in the construction of a vessel.

KEEL-BLOCKS—heavy blocks built up from the ground ways on which the vessel's hull rests during construction.

KEELSON (KELSON)—an auxiliary keel or stringer, built over the frames on the inside of the hull extending along, over and parallel to the keel; also known as inside, center, or vertical keel.

KERF—the cut or channel made by a saw; to form a channel in; to groove. Thus running a saw between two pieces of a scarf so as to make them fit tightly together, is known as kerfing the scarf.

KNEE—an angular piece of timber, usually a natural crook, used to strengthen corners; sometimes made of iron or steel; a term used to indicate that a connection has been strengthened or connected with knees.

KNEE OF THE HEAD—a large flat timber fayed edgewise on the upper forward part of the stem. It is generally formed of several pieces of hardwood coaked or tabled together edgewise. Its forepart should then form a handsome serpentine line. The principal parts are called the main piece and lacing. Its construction is not to be seen on the modern straight stem vessels, but is common where vessels carry a bowsprit, and do not have a figurehead.

KNIGHT-HEADS (BOLLARD-TIMBERS)—frame-timbers aft of and next to the stem on the outside, and continued up above the forecastle deck high enough to form the bulwarks or support for the buffalo, and support and guide the bowsprit, if one is carried; two or more stout upright timbers fastened to each side of the stem. In vessels not having a bowsprit or buffalo, the knight-heads are cut off directly below the forecastle deck.

KNOT—a division in the log marked with cloth knots or small parceling of string worked in around the strands of a rope. When a log line is used with a twenty-eight second sand-glass the knots in the log line are spaced 47.33 feet apart: when used with a thirty second sand-glass the knots on the leg are spaced 50.75 feet apart. These measurements, also known as knots, refer to the distance that a vessel would travel in one hour's time. The measurement or series of knots which pass overboard when a log line is used, in a given number of seconds, as described above, represents the distance in nautical miles of 6000 feet, that a vessel would travel in one hour.

KNUCKLE—an angle in some of the timbers of a vessel. This kind of framing is often seen around the stern. Many timbers in the Hough type of vessel construction are framed with knuckles, which are particularly noticeable fore-and-aft the line made by the timber frames, forming an abrupt angle in the shape of the ship's bottom. In shipbuilding an angle in the timber, frames or planking.

KNUCKLE-RUN TIMBERS—timbers composing the knuckles of a vessel.

L

LABORSOME—a vessel subject to or likely to labor, pitch or roll violently in a heavy sea, by which the masts and even the hull may be endangered. Oftentimes a vessel receives a series of heavy rolls and the rigging, shrouds, etc., become stretched, the masts strain upon the shrouds with such force that they are carried away, and the masts go overboard; the continual motion of the vessel under these conditions loosens her joints and planking or calking, making her spring a leak. Vessels are often lost under these conditions. There are two or three remedies: The first and most important is a high standard of construction of the vessel, such as careful and neat framing of the timbers, ceiling and planking, care and neatness and thorough workmanlike fastenings. This is a matter that is directly under the control of the men constructing the vessel. The shipyard workers should remember that a defective fastening or a poorly fitted calked seam might start a leak in heavy weather, when the vessel is laboring in a rough sea, and endanger the lives of all on board, and might result in the loss of the vessel and cargo. Second, the stability of a vessel can be greatly improved by a careful stowing of her cargo, putting the heaviest weights as near to the metacenter as possible. This improves her stability and will prevent excessive rolling.

LACING—a small rope or lanyard used to lash the head of a fore-and-aft sail to the gaff; also the rope or line used to lace or sew an awning to the awning ridge or foot-rope, by passing around the awning ridge or foot-rope stretched tightly over the awning stanchion, and sewing it through eyelets in the edge or through grommets attached to the bolt-rope of the awning.

LADDER—the inclined or vertical steps aboard a vessel, taking the place of stairs; a ladder may be used to furnish means of getting from one deck to another or from the surface of the water up the sides of the vessel to the bulwarks or on to the deck.

LAG-SCREW—a heavy round shanked wood screw with a square head.

LANYARDS—a rope rove through the deadeyes attached to the end of the shrouds and to the channels; a strain is set on the lanyards which in turn tightens up the shrouds; a rope made fast to anything for securing it, as awning lanyards, davit lanyards, guy lanyards,

LAP—a joint in which one part overlaps the other.

LAP OVER OR UPON—the mast carlings are said to lap upon the beam; the head ledges are also said to lap at their ends over the hatch coamings.

LARKSHEAD—a rope knot.

LATERAL RESISTANCE—the resistance of the water against the sides of a vessel in a direction perpendicular to her length.

LAUNCHING—the operation of placing the hull of a vessel in the water, by sliding it down the launching ways; during the process of launching, the weight of the vessel's hull is borne by the sliding ways or cradle on which she rests; the upper side of the cradle is curved and fitted to the underneath side of the hull. This cradle bears on the greased surface of the launching or ground ways, and when the cradle is released it slides down, carrying the vessel into the water.

LAUNCHING PLANK—a center plank generally used to form the track on which the bilge ways, sliding ways or cradle slide when launching, also known as ground ways.

LAUNCHING WAYS—sometimes called ground ways; outboard below the water they are called "under water ways;" the timber track, with timber ribbands or flanges on the side, which carries and guides the cradle supporting the hull, from the point where it was constructed, into the water.

LAY—the direction in which the strands of a rope are twisted; in a rope the lay is from left to right or "with the sun"; in a cable-laid rope the lay is from right to left or "against the sun"; "lay to anchor" to be attached to an anchor or mooring which is overboard and hooked on to the bottom.

LAYING OFF OR LAYING DOWN—the act of drawing the various parts of a vessel's hull full sized upon the mold loft floor; the dimensions are taken from the plans furnished by the Naval Architect. The molds are made by the loftsman from the plans drawn upon the mold loft floor.

LAZY-GUY—a term sometimes applied to a boom guy or boom pendant.

LAZY-JACK—the length of a small rope or lanyard rove through thimbles seized unto the sides of the boom topping lift and made fast to the boom. When the sail is lowered these small lines prevent the folds of canvas from falling below the boom or upon the deck.

LEACH (LEECH)—the vertical edge or side of a square sail, or the vertical after edge of a fore-and-aft sail.

LEACH CRINGLE—the cringle attached to the leach of a sail.

LEACH ROPE—the rope which reinforces the after vertical edge of a fore-and-aft sail, or the vertical sides of a square sail.

LEADING PART—that part of a tackle upon which the hauling is done; "the hauling part."

LEAK—an opening which permits the entrance or escape of any substance intended to be excluded or contained in a receptacle, tank or container.

LEDGES—oak or other hardwood scantling, which is used in framing the decks; this scantling is let into the ceiling athwartships. The ledges for gratings are similar, but are arched or rounded up to conform to the head ledges.

LEE—away from the wind, as the lee-side of a vessel.

LEEWARD—the side of the vessel or thing away from the wind.

LEFT-HAND ROPE—the three or more stranded rope, the strands of which are laid "against the sun," meaning laid over from right to left.

LENGTH BETWEEN PERPENDICULARS—the length of a vessel measured from the forward side of the stem, or forward perpendicular, to the afterside of the stern or rudder-post as the case might be, called the "after perpendicular." The after perpendicular in a sailing vessel, or where the stern and rudder-posts are combined, is the after side of the stern-post. In a steamer or vessel where the stern- and rudder-post are two separate structures, the after perpendicular would be the after side of the rudder-post.

LENGTH OVER ALL—is the length of the vessel measured from the forward side of the stem to the after side of the stern, or the permanent part of the hull structure.

LENGTHENING—the operation of spreading a vessel apart lengthways at her midship section and building in a new portion amidship to increase her length.

LET-IN—to notch or fit one timber or plank into another. Carlings are let into beams; beams are let into clamps, etc.

LEVEL LINES—the lines which determine the shape of the hull horizontally. They are made by horizontal planes coinciding with the water lines, when the ship is on an even keel.

LIFELINES—small ropes or lanyards stretched along the deck in heavy weather as a protection to the crew, to prevent them from being washed overboard; also the line shot over a stranded vessel or a vessel in distress by a life-saving crew.

LIMBER—the longitudinal gutter cut or notched into the lower side of floor frame on each side of the keelson, to permit water to drain freely into the pump well.

LIMBER-CHAIN—a chain running through the gutter or limber along the bottom of a vessel inside the planking, and used to clean out the dirt and free or clear the limber, so that water will drain freely to pump well.

LIMBER-HOLE—a hole a few inches in diameter, cut in the floor frame near the bottom to allow the bilge water to drain from one compartment space to another or to the pump well.

LIMBER-STRAKE—the bottom or lower strake in the ceiling, next to the keelson. This strake is generally made up of removable planks, which can be taken up, so as to get at the pump wells or limber and clear them from obstructions, if necessary.

LINER—a man who locates and marks out the location for the next strake of planking. He is generally a leading ship carpenter. Also a very narrow strip of wood or filling-in piece used to make up a deficiency in width or thickness of anything.

LINES—the plan of a ship that shows its form; from the lines drawn on the mold-loft floor the templates or molds are made for the various parts of the hull. A spilling line is a term used to signify a point on a plank from which the spilling measurements are taken; ropes used for various purposes aboard ship. There are many kinds of rope lines, such as head lines, bow lines, breast lines, quarter lines, spring lines, stern lines, bunt lines, leach lines, towing lines, hauling lines, etc.

LINES OF FLOTATION—in shipbuilding the plane or line in which the horizontal surface of a fluid, such as water, cuts a body or thing, as a ship floating in it; the dividing line between that part of a ship or other floating body below the surface of the water and that above it. In ships this line has an intimate relation to their buoyancy and equilibrium.

LINESMAN—a loftsman..

LINES PLAN—a drawing showing the general layout or form of a vessel. The lines comprise three plans: first, the *sheer plan*, a side view or elevation, a longitudinal section showing the water lines, bow and buttock lines; second, the *half breadth plans*, a top view, showing horizontal or floor plan at any water line; third, *body plan*, an end view, showing curves of the frames at any point of the vessel.

LINING-CLOTH—reinforcing piece of canvas sewed on a sail or awning over points where they are liable to chafe.

LIPS OF SCARPHS OR NIBS—the blunt top end left on each of the pieces of timber which form a scarph. The purpose is to give a chance to calk the scarph if necessary, and to increase the bearing.

LIST—a tilting or inclination to one side; "a list to starboard" signifies the vessel has an inclination towards the starboard side. Also to cut a narrow strip of wood out of a vessel's frame, plank or deck to examine the condition of the wood for rot.

LIZARD—a length of rope having one or more thimbles spliced on to it, and used as a leader for halyards or similar ropes.

LOCKER—a storage compartment under a seat or transom in a cabin, stateroom, storeroom, or saloon.

LOCK STRAKE—timber, ceiling or planking notched into other timber members.

LOG—an apparatus for measuring rapidity of a ship's motion. In the most common form it consists of a log chip or thin quadrant of wood about 5″ radius fastened to a line wound on a reel. When the log chip is thrown overboard its motion is arrested on striking the water, and after it has been allowed to trail a certain distance behind the ship until it has a good hold on the water, the reel is released, at the same time a sand-glass is turned over and the sand started, and after allowing the line to run the full length of time indicated by the sand-glass it is stopped. The distance run out in this interval divided by a certain constant represents the speed per hour that the ship was then running. See *Knot*.

LONG SPLICE—a method of splicing two ropes together by weaving the strands in such a manner that there is no enlargement of the rope diameter. This type of splicing is used on running rigging, and enables the spliced rope to pass freely over the sheave or through the mortise in a block.

LONG TIMBERS—timbers reinforcing the cant frames which lead from the dead-wood to the head of the second futtock.

LOOF—that part of the vessel where the planks are bent as the hull fines down or the planking approaches the stern.

LOPSIDED—a term which describes a vessel which does not float perpendicularly or with a level deck. This may be caused by the shape of her sides not being similar, or to the weights of her machinery or equipment in her hold being more on one side of the keel than the other.

LOWER MAST—the mast next the deck which is stepped on to the keel or the top of the shaft tunnel, lower hold beam or partners. The lower masts are named from their location in a vessel, as lower foremast, lower mainmast, lower mizzen-mast, lower jigger-mast, etc.

LOWER RIGGING—the shrouds, back-stays and ratlines that brace the lower masts.

LOWER SHROUDS—the shrouds and back-stays of the lower fore, main, mizzen and jigger-masts.

LUBBER'S HOLE—an opening in the mast top through which the shrouds pass when leading from bulwark channels to the lower masthead. When a masthead is rigged like this and has futtock-shrouds over the outside of the masthead top, a sailor or seaman who, in order to get to the top climbs through this hole instead of going over the outside, is called a "lubber" or "land lubber."

LUBBER'S POINT (LUBBER-MARK, LUBBER-LINE)—the fine black vertical line which is painted on the fixed inside of the compass bowl and indicates the head or fore-and-aft line of the vessel, to the deck officer, quartermaster or helmsman when steering by compass.

LUFF—the forward edge of a fore-and-aft sail.

LUFF-CRINGLE—the iron ring or shape which is spliced into the bolt-rope of a gaff sail, at the angle formed by the boom and luff, or into the angle of a fore-and-aft sail formed by the junction of the head and luff. Triangular or jib-headed sails have but three cringles, head, tack and clue. Gaff sails have four cringles; peak, tack or nock, throat and clue.

LUFF-TACKLE—a light handy tackle purchase, formed of a length of rope and a double and single block. The double block is always the head-block through which hauling part is rove.

LUFF UPON LUFF—one luff-tackle applied to the hauling part of another luff-tackle. This gives an extremely powerful purchase for the power applied to hauling part.

LUMBER-PORT—the port or opening fitted with a water-tight door on each side of the bows and stern of a vessel, used for passing long lengths of timber into the hold. Long lengths of timber can be handled in this way that could not be stowed or passed into the hold through the hatches.

M

MADE MAST (MADE BLOCK)—is a mast built up from several pieces of timber, likewise a made block. Topmasts and topgallant masts are nearly always whole spars or made from one stick.

MAGAZINE—the compartment or room in which ammunition for guns or rifles is stored.

MAGNUS OR MAGNER'S HITCH—a rope knot; a method of attaching a rope to a spar.

MAIN-BREADTH—the widest part of the hull (or any particular timber) which is designated on the sheer draught plan by the upper and lower heights of the breadth line.

MAIN-DECK—the principal deck of a vessel, usually continuous from stem to stern; this deck gives great strength to the hull; called upper deck in the Ferris type of vessel.

MAINMAST—the mast that is next abaft the foremast of a vessel carrying two or more masts. The mast in a single-masted vessel is also called the mainmast.

MAIN-RIGGING—the shrouds or ratlines of the lower mainmast.

MAINSAIL—the square sail bent on to the main yards; a fore-and-aft sail, which is stretched on the main boom. In order to be mainsails these sails must be attached to the mainmast.

MAIN-SHROUDS—the shrouds of the lower mainmast.

MAINSTAY—the hemp or wire stay that leads from the mainmast head to the deck near the foot of the foremast, where it is made fast and set up tight. This stay is a fore-and-aft brace for the mainmast.

MAIN-WALES—the lower wales of the outside planking of a vessel; they are generally placed in the side planking, so the main deck knee bolts of fastenings may be secured into or through them.

MAKE SECURE—the term signifies the process or act of securing or fastening securely in place, as "Make secure the anchor."

MANGER—a partition or low bulkhead extending athwartship immediately back of the hawse hole. It prevents the passage of water aft along the deck, which may flush up through the hawse pipe in a heavy sea or may drip from cable when heaving in. Scuppers or freeing ports are fitted into the side of the vessel near the manger to carry the water overboard.

MANHOLE—a round or oval-shaped hole cut in a bulkhead, partition or deck, etc., which is large enough for a man to pass through.

MANIFOLD—see *Pump Manifold.*

MAN-ROPE KNOT—a knot made in a rope in such a way that a man may climb the vertical sides of a vessel, using the knots to increase his hold.

MAN-ROPES—ropes that hang down over the vessel's sides to assist in ascending or descending. They are often fitted on a Jacob's ladder.

MARL—to hitch a marlin, spun yarn, etc., around the parceling to keep it in place while it is being served.

MARLIN—a two-threaded strand tarred hemp about ⅛" in diameter used for seizing rope.

MARRY—to sew the ends of two ropes together temporarily, so there will be no enlargement, and the ropes so bound will render or pass through the ship's block. This is the method of reeving a new signal halyards, and saves sending a man aloft.

MASTER SHIPBUILDER—a highly skilled and experienced directing superintendent, who is responsible for the good workmanship in the construction of a vessel's hull.

MASTHEAD—the top or upper part of a mast; when referring to the masthead of a lower mast it indicates that part of the mast from the crosstree to the cap or extreme end. To masthead a man, a method of punishment, is sending him aloft to remain a definite time. Mastheading a yard or sail is to haul it up by the halyards as high as it will go.

MAST-HOLE—a hole in the deck of a vessel or in the thwart of an open boat, through which the mast is fixed or stepped.

MAST-HOOP—a wood or metal hoop that goes around a mast and to which the luff of a fore-and-aft sail is seized by lashing or robands. These hoops hold the sail to the mast and travel up and down when the sail is hoisted or lowered; they are sometimes called "sail hoops."

MASTING—a term indicating the process of determining the position in which the masts of a vessel are to be placed; also indicates the mechanical process of stepping the masts.

MAST—the long principal spar generally placed nearly vertical on the center line of a vessel; all the ship's rigging and spars are attached to or carried on the masts.

MATTHEW WALKER KNOT—a rope knot named after the originator, used as a finish of deadeyes, lanyards and mastheads.

MAULS—heavy steel-faced hammers, used for driving bolts, treenails or other fasteners. Top mauls have a hammer face on one end, and the other is drawn out small and pointed. Two-faced or double-faced mauls, a steel face on each end, are used for driving bolts, etc. A two-faced or double-faced maul is similar to a sledge except the weight is less.

MEASUREMENT—measurements when applied to a vessel are the dimensions of length, breadth, depth, capacity or weight.

MESSENGER—a tackle-block rigged on a rope in such a manner that it can travel the length of the rope and carry anything, such as a case, timber or part of the cargo.

METACENTER—the shifting center; the limiting position of the point of intersection between a vertical line passing through the center of gravity of a floating body, as a vessel, when in equilibrium, and the vertical line drawn through the center of buoyancy when the body is slightly displaced. To insure stable equilibrium, this point must be above the center of gravity.

MIDDLE A ROPE—to double a rope into two equals parts.

MIDDLE LINE—a line dividing a ship exactly in the middle; a meridian line. In a half-breadth plan it is a line bisecting the ship from stem to stern. In a body plan it is a perpendicular line bisecting the ship from the keel to the highest part of the vessel, as shown on the plan.

MIDSHIPS—a term indicating the middle of the ship's length.

MIDSHIP SECTION—that cross-sectional part of a vessel which is the fullest; it is generally located midway between the perpendiculars, but in some cases is nearer the stern. It is also, in most hull designs, at the lowest point of the sheer.

MIZZEN-MAST—the after mast on a three-masted vessel.

MIZZEN-RIGGING—the shrouds and ratlines of the mizzen-mast.

MIZZEN-SHROUDS—the shrouds bracing the lower mizzen-mast.

MIZZEN-STAY—the fore-and-aft hemp or wire rope that leads from the mizzen-mast head to the foot of the mainmast, where it is made fast to the deck and set up tight. This is a fore-and-aft brace for the mizzen-mast.

MOLD (MOULD)—a pattern or template of a part of a vessel's frame, structure, etc.; molds are usually made of thin wood, battens or boards.

MOLDED (MOULDED)—cut to the shape of a mold or template.

MOLDED BEAM (MOULDED BEAM)—molded breadth; the greatest width of a ship from outside face of frame to outside face of frame at the amidship section.

MOLDED DEPTH (MOULDED DEPTH)—the depth measured from the top of the keel to the top of the upper deck beam, less the round or camber of the beam.

MOLDER (MOULDER)—same as loftsman; the man who makes the mold or does the molding.

MOLDING EDGE (MOULDING EDGE)—the edge of a mold, template or piece of wood from which the shape or contour of frames, bevels, etc., are laid off or the outlines of the timbers or planks are shaped.

MOLD-LOFT (MOULD-LOFT)—a shed or building with a smooth floor of great area on which the lines of a vessel can be laid or drawn to full size.

MONKEY-BLOCK—a small swivel block containing one sheave; the block is generally stropped with a manila line.

MONKEY-GAFF—a light signalling gaff placed above the spanker gaff on the mizzen-mast of a ship; it generally projects from the topmast head. Signal halyards are rove through the end of this gaff. This method of securing signal halyards enables the signal flag to be carried high up, away over the mast and unobstructed by the sails, giving it great visibility.

MORTISE—a hole or hollow made a certain size and depth in the side or face of a timber, to receive a tenon worked on the end of another piece of timber,—with careful workmanship the tenon should exactly fit the hole; the hole cut in the shell of a pulley or tackle block to receive the sheave.

MORTISE-BLOCK—a tackle-block the shell of which was formerly made of one piece of wood, but now generally built up from several pieces in such a manner that the sheave is entirely protected by the cheeks or sides of the block.

MOUSE—a kind of washer put over a chain or rope to prevent the latter from slipping or passing down through a hole; a term applied to the process of passing a rope, yarn or marlin around the shank and over the point of a hook, and thus effectively closing the gap in the hook and preventing the hook from being detached.

MUNIONS—the pieces that are placed vertically to divide the panels in frame bulwarks, also between the lights in the ship's stern and quarter-galleries. These pieces make a finish and break up the effect of a large or long flat surface.

N

NAILS—the iron, steel or other metal pins of various kinds used to fasten boards, planks or iron work in a vessel together. In a shipbuilding yard there are many different kinds of nails used, the use to which they are applied being indicated by the name they bear:

Boat nails, commonly used by small boatbuilders, are of various lengths, generally rose-headed and square at the point; they are made of copper or soft iron or steel.

Clamp nails are very thick nails, with large heads, used for fastening iron clamps, etc.

Deck nails, or spike nails, are from 4½ to 12 inches long and have snug heads. These are used for fastening planks in the flat of the deck.

Filling nails, not now used, were generally of cast iron, and were driven thickly into the bottom planks; they were used to take the place of copper sheathing.

Flat nails are small, round-pointed nails, with flat, thin heads, used for nailing scarphs of molds.

Lead nails are small, round-headed nails for securing lead sheets in position.

Port nails, double and single, are similar to clamp nails, and are used for fastening iron work.

Ribband nails are similar to weight nails, except they have large, round heads, so they can be easily withdrawn; they are used as temporary fastening for ribbands, etc.

Rider nails are similar to clamp nails, but are chiefly used for fastening pintles and braces.

Scupper nails are short nails with very broad heads, used to secure the flaps to the scuppers.

Sheathing nails are copper or cast bronze nails, with flat polished heads, and are used for fastening copper sheathing to the planking.

Sheet nails, not now in use, were used to fasten wooden sheathing on a vessel's bottom; their purpose was to preserve the planking and prevent the filling nails from tearing the planking too much.

Weight nails are similar to deck nails, but not so small, have square heads and are used for fastening cleats, etc.

Wire and cut nails; their size and length are indicated by the term "4, 6, 8, 10, 24, 30, 40 penny nails." These are used for nailing boards and planks in position.

NAVAL ARCHITECT—a man who has had a special technical education and is competent to design vessels.

NAVIGATING BRIDGE—the deck or bridge from which the navigating officer handles a vessel. The location of this bridge on a vessel and the height of the bridge above the water vary according to the design and the ideas of the naval architect or owner.

NET OR REGISTERED TONNAGE—is the gross tonnage less certain deductions, as set forth in the regulations and laws of the United States. The resultant figure is in cubic feet. This divided by 100 gives the net or registered tonnage.

Two other net or registered tonnage measurements are required on vessels sailing under the flag of the United States: One is the Panama Canal measurement, which is performed in practically the same way except the deductions and exemptions are different. This measurement is regulated by the statutes of the United States. The other measurement is the Suez Canal measurement, and is performed in practically the same way except the deductions and exemptions are slightly different. The method of taking this measurement and the exemptions and deductions are regulated by the Suez Canal Measurement Rules.

NETTING—a rope network that is used aboard a vessel for various purposes, such as a bag fastened to the foot of the fore, main, mizzen, jigger, top and lower mast stays on board a steamer, and in which the fore-and-aft headsails are stowed instead of being furled. It is also applied to the bulwark network, which takes the place of solid panel bulwarks on some steamers.

NET TONNAGE—the capacity under the deck available for stowing the cargo only. It is exclusive of the engine-room, boiler space, coal bunkers, cabins, crew, space, etc.

NIB—the thin point or extremity of a scarph.

NINEPIN BLOCK—a swivel tackle-block, which is shaped similar to a ninepin.

NIP—a twist or kink in a rope.

NIPPERS—a short length of rope used to secure a cable to a messenger.

NOCK—a name sometimes applied to the forward upper corner of a fore-and-aft sail.

O

OAKUM—tarred strands of old hemp, manila or jute rope or other soft vegetable fiber finely combed out and spun into loose strands, used in calking a seam.

OFFSET—the horizontal distance measured at right angles from the center line of a vessel to points on the side framing at each frame intersection and at predetermined perpendicular heights. The naval architect always furnishes with the sheer, body and molded plans a table of offsets, and this enables the loftsman to correctly check his layout on the moldloft floor.

ON BOARD—in or on a vessel; on the upper deck in open air.

ORLOP—a deck below the berth deck on warships on which cables are coiled, probably now obsolete. Sometimes used as a term for the lowest deck.

OUTBOARD—a term applied to indicate away from the center line of a vessel—towards the sides of a vessel.

OUTHAUL—the rope that hauls out the clue to a point of the boom of the fore-and-aft sail, which is furled against the mast.

OUT OF WIND—a term indicating a twisted surface; out of line.

OUTRIGGER—a spar or iron forging, which projects from the crosstrees of lofty rigged vessels. The purpose of outriggers and cross trees is to give spread to the backstays and support them in their middle section, also prevent excessive vibration of the rigging from the wind.

OUTSIDE MACHINIST—a man who erects machinery and equipment on a vessel, and afterward assists in the operation of the machinery on a test or trial trip.

OVERBOARD—a term indicating outside; over the side of a vessel into the water.

OVERBOARD DISCHARGE—the pipefittings and holes through the side of a ship or vessel through which the sanitary, condensing, bilge or fresh water passes or water pumped from the vessel overboard.

OVERHANG—the portion of a vessel's hull overhanging and unsupported by the water, at the stern abaft the rudder-post or under the counter.

OVERHAUL—to separate the pulley blocks of a tackle by hauling one tackle-block away from the other.

OVER-LAUNCH—to run the butt of one plank in a strake one or more frames beyond the butt of the adjoining plank in the next strake. This prevents the butts coming in the same plane and developing a weakness at that point of a vessel.

OVER-SPARRED—a vessel which has heavier masts, yards or booms than are believed to be necessary, is said to be over-sparred.

P

PACKING PIECE—thin piece of wood fitted between two timbers, to fill up a deficiency.

PALLETING—a light platform or grating built above the bottom of the magazine or storage apartment for ammunition, to give ventilation and keep the ammunition from absorbing moisture.

PAWLS—stout pieces of iron or steel, pivoted at one end, so that they drop into position of their own weight. They are attached to the base of the capstan or windlass in order to prevent it from revolving, except in one direction. Thus, with this device, when an exceedingly heavy strain comes upon the hawser or line being wound in, the pawl at the bottom or side of the windlass, revolving from or with capstan, engages the teeth of the ratchet, on the fixed base or foundation, and effectively prevents the revolution of the drum, except in one direction.

PARCELING (PARCELLING, PARSLING)—the long strips of canvas sometimes wound spirally around a rope so as to give a smooth surface; the process of wrapping or winding a rope with parceling,—tarred strips of canvas.

PARTNERS—the pieces of timber let in between two deck beams to form a framing for the support of anything which is carried on or passes through the vessel's deck, such as capstans, winches, pumps or masts.

PATTERN—see *Mold.*

PAY (PAY A SEAM)—to lay on a coat of tar or cement with a mop or brush in order to preserve the wood and keep out the moisture. When one or more pieces of timber are scarphed, joined or tenoned together, the inside of the scarfs or any surface of the wood coming in contact with another surface, particularly the ingrain, are payed with tar, creosote or other preservative or antiseptic preparation. Seams between planking or deck are also payed with tar, cement or some other preservative after they are calked. Pitch is generally used in this case, as it more effectively excludes the water.

PAY OUT (PAYING OUT)—to slack away on a rope, chain or cable.

PEAVIE (PEAVY, PEEVY, PEEVIE)—a lumberman's cant hook, having a strong metal spike at the socket end of the staff.

PILLAR—a vertical member, stanchion or column, giving support to a deck.

PINK—a vessel with a narrow, round stern, hence all vessels, however small, having their sterns narrowed in this manner, are said to be pink-sterned.

PINTLES—a metal pin secured to the forward side of the rudder by a strap. The pintle is fitted into a gudgeon, which is secured to the rudder-post. The pintle and gudgeon together form the hinge on which the rudder swings.

PIPE-FITTER—an artisan who installs iron, steel, brass, galvanized pipes or steel tubing, for high and low pressure steam, hot and cold water supply systems, air, oil and refrigerating systems. He is the man who would connect a great deal of the pipe work in and around the main engine, boilers and auxiliaries.

PITCH—pine tar boiled until it forms a highly viscous, elastic substance. Pitch when heated and payed on will effectively exclude the water from the face or ends of timbers. It is generally used for paying a seam between planks after calking. Pine tar pitch is the residue from the distillation of turpentine.

PITCH OF THE PROPELLER—the motion of a vessel when she plunges her head or bow and her stern alternately into the sea, when the waves are very high and the sea rough.

PLANKING—the timber covering on the outside of the vessel's frame; the process of putting on the planks or covering the exterior surface of the frames with planks beveled and felled accurately in place. It is referred to as "sheathing a vessel."

PLANK-SHEER—the gunwale; the planking laid horizontally along the sides of the timber heads for the purpose of covering, and securing the top ends of the futtocks or bulwarks, sometimes called "covering boards."

PLANK STRAKE—a continuous breadth of planking from stem to stern, always laid on the outside of the frame.

PLATFORM—a partial deck.

PLIMSOLL—a mark painted on the outside of an English vessel, amidship, on both sides, showing how deeply she can be legally loaded. So called from Samuel Plimsoll, who secured the passage of the Merchants' Shipping Act by the English Parliament in 1876. The marks are painted in white, and are generally as follows: A circle with a bar across the middle. Following this is a vertical bar with four horizontal bars on the fore side, and one horizontal bar on the after side, the after horizontal bar being the highest. These five marks are known as follows: The after highest bar being known as fresh water load-line, sometimes marked "F. W.," the depth a vessel can load in fresh water. The highest mark on the forward side of the bar is known as Indian Summer, sometimes marked "I. S." This is the highest load-water line for vessels crossing the Indian Ocean in summer time. The next horizontal bar below is the summer load-water line, and this is for vessels sailing in any location except the Indian Ocean, and which will be known to arrive or depart within the summer season. This line is sometimes

marked "S." The next mark below this is the winter load-water line, sometimes marked "W." This is for vessels sailing in any location which are expected to depart or arrive in the winter season. The lowest mark of all is known as the "Winter North Atlantic." This is for vessels crossing or sailing on the North Atlantic during the winter season. This is sometimes known as "W. N. A." Inasmuch as the North Atlantic is known to be the roughest sea, except around Cape Horn and the Cape of Good Hope, it is considered desirable for the vessel to have the greatest freeboard.

PLUG—the rounded part of the rudder-stock.

PLUMBER (MARINE)—a man who runs and fits lead piping and fixtures, installs bath-tubs, closets, urinals, showers, lavatories and sinks. He should also be able to use sheet lead in lining tanks, refrigerators, galley dressers, line pipe with lead tubing and cast the lead base for closets from a wooden pattern, rammed and molded in the sand.

POINTER—a wooden reinforcing timber laid and fastened diagonally across the ceiling near the bow and stern of a vessel. Pointers are generally carried from the stem aft and the stern forward until they reach the full body of the vessel. Their purpose is to help stiffen and strengthen this part of the vessel.

POOP—the raised after portion of the vessel above the upper or quarter deck.

POPPETS—timber blocking at the extreme forward and after end of the cradle, which supports the hull of a vessel at these points during the launching operations. The poppets must be very carefully fitted to the exact shape of the hull at the points where they bear, and must be securely fastened together across the ship to prevent spreading while the vessel is in motion down the ways. The forward poppets in end launching, or the poppets near the bow, take the weight of the forward end of the ship at the time the after end commences to float or takes its buoyancy. In large vessels this weight runs up to several hundreds of tons at this period of launching.

PORT—the left-hand side of a vessel when looking from aft forward; an opening in the ship's side or deck house.

PORT-HOLE—a circular or rectangular hole in the ship's side or house fitted with a metal, water-tight frame and cover.

PORT-LID—the lid or cover of a port-hole.

PORT-LIGHT—a heavy glass plate on a hinged frame, fitted to a port-hole.

PORTS—ports are square or rectangular openings in the bulwarks or top sides of a vessel and serve various purposes, such as ballast ports, for stowing ballast, bow-ports, stern-ports and lumber ports to allow cargo or material to be passed in or out from the deck or hold of a vessel; freeing ports along the bulwarks to allow the water on the deck to run freely over the sides; coaling ports, on the sides of a vessel through which the coal passes on the deck or into the bunkers.

PORT TACK—when a sailing vessel is under way and her boom and spars are on the starboard side and the wind is coming from the port side, the vessel is said to be on the port tack.

POWDER-HORN—a term indicating a compound curve.

PROFILE OR SHEER—a plan showing the longitudinal elevation of a ship's lines, generally drawn with the stem placed to the right-hand. This plan should show the sheer of the rail, knuckle, decks, the position of the frame stations or sections and the level or water-lines. It should also indicate the form of the ship at the center line and at the fixed longitudinal vertical planes, parallel to the center, called the bow and futtock lines.

PROPELLER—a revolving device in the water under the stern driven by and attached to the after end of the shaft (called the tail-shaft), which is in turn driven by the engine. By its rotary motion, this device forces the vessel through the water. A propeller consists of two or more plates, blades or paddles set at an angle to the center line of the shaft and twisted with a very sharp pitch like a screw thread. This device, when revolved, cuts through the water, and due to the reaction of the water on the surface of the blades forces the vessel forward or astern, as the case may be, according to the direction of rotation of the shaft.

PROPELLER-POST—the stern-post of a vessel or post to which the propeller or tail-shaft outboard bearing is bolted.

PROTECTIVE DECK—the deck in a warship protecting the magazine, engine, fire-room and machinery compartments. This is generally oval or almost flat and built of armor plate. The openings or hatches on this deck are protected with a heavy armored grating.

PUDDING-BOOM—a boom lashed in a horizontal fore-and-aft position between two boat davits. When boats are swung outboard at sea ready for lowering, they are lashed tightly against this boom, so they will not swing and be smashed when the vessel rolls in a sea way.

PUMP—a mechanical device fitted on the deck or in the engine or fire-room space, the purpose of which is to remove the water out of the hold or tanks and discharge to any desired point. A pump can pump water from the hold overboard, it may be used to pump water from overboard through the ship's sanitary system and then overboard, or it may be used to pump fresh water from the fresh water tanks to the cook's galley, boilers, etc.

PUMP-CISTERN (WELL)—the cistern or well into which the water drains. The suction pipes lead from these cisterns to the suction chambers of the pump.

PUMP-DALES—pipes or drains fitted to discharge the water from a pump over the ship's side, sometimes called the "overboard discharge."

PUMP-MANIFOLD—a series of suction and discharge pipes connected together on the side of a pump in such a manner that the pump can take its suction from any valve or pipe and discharge to any valve or pipe at the will of the operator.

PUNCH—a mechanical device or machine for punching holes in iron or steel plates, bars, angles or shapes.

Q

QUADRANT—a fitting on the rudder-head, being, as its name signifies, one-fourth of a circle, and on which the steering chains or tiller-ropes are attached. This device replaces a tiller on large vessels.

QUARTER (QUARTERS)—that part of the vessel's side near and under the stern; the living accommodations or rooms on board a ship.

QUARTER-BADGE—the decorative scroll work on the side of a vessel at the forward end of the quarters, near the stern.

QUARTER-DECK—that portion of the weather deck next to the stern. In the Ferris ship it would be the after part of the upper deck.

QUARTER-LIFTS—the double topping-lifts that lead from the iron band near the outer or top end of a boom up to and through single blocks, secured to the mast, under the eyes of the shrouds at the head of the lower mast, thence down to the deck. To the lower end is attached a purchase tackle. Flexible wire rope can be used from the boom end up to the masthead, and down to the purchase tackle.

QUICKEN—to give anything a greater curve; "to quicken the sheer," to shorten the radius by which the curve is struck. This term, therefore, is the opposite of "straigthening the sheer."

QUICK-WORK—that part of a ship which is above the chain wales and decks, and is so called in shipbuilding because it can be rapidly constructed.

R

RABBET—a depression or channel in a piece of timber cut for the purpose of receiving and securing the edge and hood ends of bottom and side planking, as for example, the rabbet in the stem or stern to take the hood end of planks, or the rabbet of the keel and dead-wood to receive the garboard strake. There are three parts to a rabbet: rabbet line, the front or exposed edge of the rabbet; back rabbet, or line formed by the bottom angle of the rabbet; and the bearding-line, or the line formed at the inside or near edge of the rabbet, which comes against the inside face of the planking.

RACE-KNIFE—a tool having a U or V shaped blade, used in scribing or etching permanent marks on timber work.

RACK—to seize or bind two ropes together with turns of spun yarn or marline, so they cannot move or pull apart; a straight piece of iron, steel or other metal with teeth cut or cast on one broad face. These teeth engage corresponding teeth in a gear or pinion.

RACK-BLOCK—a length of wood which contains a number of sheaves, which is generally attached to the rail or the side of the mast. Rack-blocks are generally used as fair leaders.

RAG-BOLT—a bolt having the sides at the point ragged or barbed to make it hold securely.

RAIL—the top finished part or the upper edge of the bulwarks; the iron, steel or other metal strips attached to the face of a mast or to the under side of a gaff or top side of a boom to carry the head luff and foot of a fore-and-aft sail.

RAILWAYS—permanent rail or rails bolted to the under side of the standing gaff, after side of a mast or the upper side of a boom in place of jackstays. This method of rigging a sail is used on steam vessels. The head of the sail is hauled out along the gaff or boom with an outhaul line and brailed against the mast when it is desired to furl it. These rails have clamps fitted loosely over the rail, which are attached to eyelets in the sail at the bolt-ropes.

RAKE—the overhang of the stem or stern beyond the perpendicular to the keel; any part or thing that forms an obtuse angle with the horizon, as the rake of the mast, or the rake of the smokestack.

RAM-LINE—a small wire line or cord used to strike off the center of a vessel or to run its sheer lines, determine the hang of the beams, or for setting the beams fair; a chalk line used to indicate the curvature, crown or upward spring to be put in a beam.

RAMP—the inclined walk built up along the ship's sides when on the building ways, used by the shipbuilders, as an easy means of reaching the deck or upper bulwarks.

RASING—the act of marking by a mold on a piece of timber, or marks made with a tool called a "raising knife." See *Race-Knife*.

RATLINES—short lengths of ratline-stuff seized with a clove hitch across the shrouds about 14 inches apart, parallel with the sheer poles or decks. These ratlines are similar to the rounds or rungs of a ladder and are used by the crew when ascending or descending from aloft. Ratlines extend from the swifter or forward shroud to the one next to the after shroud. It is the custom to carry every fifth ratline to the after shroud. This ratline is called a "sheer" or "catch ratline."

RATLINE-STUFF—a small tarred line that is used to rattle, mouse or seize rigging. Sometimes applied to marlin or small spun threads or yarn of manila or hemp.

REAM (REEM, REAMING)—a term used by calkers, being the act of opening a seam between planks to facilitate calking so that oakum may readily be inserted; to enlarge a round hole with special tools, called reamers, to an exact diameter.

REAMER—one who reams; a tool used in reaming a round hole.

REAMING-IRONS—special irons used by calkers to open or ream a seam.

RECONCILE—to make one piece of work fair with the mold or shape on the adjoining face, more particularly in the reversion of curve or bevel.

RED LEAD PUTTY—a mixture of whiting and red lead, used for various purposes, such as filling up deck seams, after calking the cracks in timbers.

REEVE—to reeve a rope is to pass the end of it through the mortise of a tackle-block, over a sheave, through a deadeye, bullseye or any hole.

REGISTERED TON MEASUREMENT—the measurement based on a ton of 2240 pounds occupying 100 cubic feet of volume.

RELIEVING TACKLE—a tackle which is hooked to the tiller in a gale and makes it easier to steer the vessel. A tackle by which the vessel may be steered in case of emergency or damage to the tiller-ropes or steering-wheel.

RENDER—a rope renders when it passes freely through the mortise of a block or other hole; to serve or wind with marlin, rope, yarn or small stuff.

RENDS—large open splits or shakes in timber, particularly undesirable in planking, and caused by exposure to a dry wind or hot sun.

RETURN SOUND TUBES—the steel or fiber tubes which connect the wheelhouse or navigator's bridge with the engine-room, and are used to convey the sound of the gongs or bells to the officer of the watch or deck, quartermaster or wheelman. By this means they are sure the signal which they have given is audible in the engine-room.

RIBBAND—temporary longitudinal pieces of small timber or heavy battens, nailed or lag-screwed to the frames, to hold them in position during construction. Special ribbands at the bow and stern, which are shaped to the contour of the vessel, are called harpins. The ribbands and harpins are removed when the planking and ceiling reach their position.

RIBBAND LINES—the same as diagonal lines.

RIDER KEELSON—the upper tier of keelson timbers.

RIDERS—fore-and-aft strengthening timbers fastened to the inside of the ceiling. These extend diagonally from the keelson to the beams of the lower deck at the bow and stern.

RIDGE-ROPE—a rope rove through holes in the upper ends of awning stanchions, used to secure the awning, when it is spread.

RIGGER—a man who splices, serves and fits the wire and manila ropes, shrouds and cables on a vessel. He makes and repairs the slings used for hoisting, on the vessel or in the shipyard, and installs the standing and running rigging on a vessel.

RIGGING—all the ropes on a vessel, more generally applied to all the movable ropes, as cargo, guy, halyards, downhauls, outhauls, etc. The shrouds, stays, back-stays, etc., are called "standing rigging."

RIGGING LUFFS—watch-tackle purchases which are used for setting rigging up taut.

RIGGING MAT—a pad that is seized on the standing rigging, stay or shroud to prevent chafing.

RIGHT-HAND ROPE—the three or more stranded rope, the strands of which are laid "with the sun" meaning laid over from left to right.

RINGSTAFF—a stout pole held at one end by a ring bolt, used as a lever to pull or force planks or ceiling into place against a ship's frame when fastening same.

RISE OF BOTTOM—in shipbuilding is the measurement from the produced line of the midship section of the bottom at the intersection of the produced line of the half-breadth perpendicular. The distance from the point where the produced line intersects the half-breadth perpendicular to the horizontal line carried out from the intersection of the produced line of the bottom at the side of the keel, is called "use or rising of the bottom." In steam vessels the produced line is straight, but in war vessels or yachts it may be rolling or hollow.

RISING—a term derived from the shape of the ship's bottom in general, which gradually narrows or becomes sharp towards the stem and stern-post. On this account the floor towards the extremity of the ship is raised or lifted above the keel. This condition is called "rising floor" or "rising wood."

RISING FLOOR—the floors of the ship forward and abaft the square section, which on account of the rising of the body of the ship, are most difficult to construct.

RISING-LINE—an elliptical line drawn on the plan, elevation or sheer plan to determine the sweep of the floor heads. The location of these lines determines the shape of the bottom at the bow and stern with regard to its being flat or sharp.

RISING OF BOATS—the narrow, thin strake of planking which is fastened along inside the frames to support the thwarts of a small boat.

RISING WOOD—see *Rising; Rising Floor.*

RIVET—a short metal bolt without nut connecting two or more members, usually in sizes over ½" diameter, driven, upset or clinched while at a red-hot heat; ⅜" diameter and smaller are driven, upset and clinched while cold.

ROBANDS (RIBBANDS)—gaskets used to secure a sail after it has been furled.

ROLLING—the motion by which the ship rotates from side to side, alternately raising and lowering each side of the deck. Rolling is, therefore, a partial revolution about an imaginary axis. This axis is known among ship designers as the metacenter; this point can be mathematically located. Its location must always be above that of the center of gravity, no matter what condition of loading the vessel exists, *i. e.*, light without stores, light with stores, loaded, or loaded to the deepest draft. If the metacenter is above the center of gravity of the vessel, the stability is secured; if the metacenter is below the center of gravity, the vessel is in a dangerous condition, and it is not safe to proceed to sea under these conditions.

ROLLING HITCH—a rope knot.

ROSE-LASHING—a rope-lashing tied or knotted in a certain way.

ROUGH TREE RAILS—broad, flat rails running fore-and-aft, covering the top timbers, thus forming the top rail of the bulwarks. In merchant vessels the rails in the waist and quarters are built up nearly breast high, to prevent persons on deck being washed overboard in heavy weather.

ROUND LINE—three strand yarn used for heavy serving, such as eyes for rigging, heavy seizing, etc.

ROUND-RIBBED—a vessel carrying very little run or which is flat-bottomed.

ROUND SEIZING—the seizing that is used on the eyes of rigging.

ROVE—to pass a rope through an eye or through the mortise or over a sheave in a tackle-block.

RUDDER—a large, heavy flat device of varying shape, hinged vertically to the rudder-post, used for steering or changing the direction of a vessel's travel, while moving or under way.

RUDDER-BEARER—a surfaced deck plate bolted down to the timbers supporting the quarter deck directly over the rudder. On this plate a similar plate is placed with a surfaced face turned down and bearing on the deck plate. This second plate is bolted to the rudder-stock and takes the whole weight of the rudder off the pintle and gudgeons.

The rudder bearer is sometimes fitted with ballbearings instead of the surfaced plates.

RUDDER-CHOCKS—see *Rudder-Stop.*

RUDDER-GLAND—the collar holding the packing in the stuffing boxes on the rudder-stock. These glands make the rudder stuffing boxes tight, so that the sea cannot enter the ship at the stern through the rudder-trunk.

RUDDER-HEAD—see *Rudder-Stock.*

RUDDER-POST—a heavy vertical post at the after end of the stern frame supporting the rudder, also known as the "after perpendicular" or "A. P."

RUDDER-STOCK—the vertical shaft attached to the rudder blade, and on which the pintles are bolted. The top of this shaft is attached to the tiller or rudder quadrant. The power applied from the steering engine or other steering devices, through the rudder quadrant is transmitted by the rudder-stock to the rudder-blade, moving it from side to side, at the will of the man operating the steering-wheel, thus steering or directing the course of the ship.

RUDDER-STOCK HOLE—the hole in the counter or overhang at the stern, where the rudder-stock enters the hull and rudder-trunk.

RUDDER-STOP—a device fitted on a rudder-post to limit the swing or travel of the rudder from side to side.

RUDDER STUFFING-BOXES—the metal castings attached to the rudder-stock and to the hull of a vessel at the rudder-stock hole. These stuffing-boxes have a gland and recess for packing. By means of the stuffing-boxes the water can be kept out of the vessel.

RUDDER-TRUNKS—a water-tight trunk, box or casting made of wood or steel, built about the hole in a ship's stern and extending up to the quarter deck through which the rudder-head passes. The inside of this trunk should be of sufficient size to allow the rudder-stock to pass into position without removing any of the structure when hanging the rudder.

RUN—the narrowing of the ship abaft the square section as the change in the curve of the floor towards the stern-post. This term is also used to describe the process of drawing a line on the ship or mold loft, as to "run the wale line or deck lines."

RUNG-HEADS—the forward ends of the floor timbers.

RUNNER AND TACKLE—a rope rove through a single block bent to the hauling part of a line or tackle. One part of this rope is secured to the deck or some permanent object and the other end is the hauling part. With this rig additional purchase power is obtained.

RUNNING BOWLINE—a bowline made from the standing part of its own rope, so as to form a sliding noose.

S

SADDLE—a forging, casting, or timber shape, bolted to the sides of masts, deck houses or other convenient points, to receive the outboard ends of booms or spars. They take the place of crutches.

SAG—the downward curvature of the deck, or anything, as opposed to camber.

SAGGING—the strain on the ship which tends to make the keel or a boom bend lower in the middle, as opposed to hogging. This condition prevails in the keel when a very heavy cargo is loaded near the midship section of the vessel with light or no cargo at the ends.

SAILMAKER—a man who cuts, sews and fits sails and awnings for a vessel.

SAILMAKER'S SPLICE—a rope or splice used by sailmakers in uniting two ropes of different sizes.

SAIL OR AWNING COVERS—a canvas cover which is placed over sails or awnings when they are furled or clued up. Their primary object is to protect the sail from moisture or destructive mildew, and also by their neatness improve the looks of the vessel.

SAIL PLAN—the side elevation of a vessel, showing the sails as they would appear when they are bent and stretched.

SAILS—pieces of stout fabric; in modern sailing vessels, usually of cotton canvas, which are attached to the masts, spar, yard or stay of a vessel, ice boat or vehicle, so that it may be spread to the wind to aid in its propulsion and also by adjustment assist in maneuvering. The distinctive parts of a sail are the head, which is the top edge along a gaff or yard; the foot, which is the bottom edge, sometimes stretched along or bent on to a boom; the leach, which is the after or outside vertical edge of the sail; and the luff, the forward vertical edge of the sail, generally against the mast. Sails are distinguished by two principal types—square sails, sails having four sides, the top side being generally bent onto a yard and nominally carried at right angles to the keel; and fore-and-aft sails, which are attached to the boom, gaffs or stays, and are nominally carried parallel to the keel.

SALT—to put salt between the planks and ceiling or in special boxes in the vessel's hold. This is an old method of preserving the timber from rot.

SALT STOP—a board fitted between the planks, ceiling and frames to prevent salt used to preserve the timber from falling down into the ship's bilges.

SAMSON POST—Belaying post; a heavy vertical post that supports cargo booms, also a heavy upright timber or post fastened through the deck for the attachment of ropes or belaying of ropes or hawsers; a single bitt, sometimes used to prevent the deck-load from shifting from port to starboard when the vessel rolls in a heavy sea.

SAND-GLASS—a glass consisting of two equal, nearly conical receptacles connected by a small opening at the vertices. One of these receptacles contains sand, which, if the glass is turned, runs through the opening into the other receptacle. The amount of sand in the receptacle is so regulated that a certain space of time is exactly measured when all of the sand has passed from one receptacle into the other. A sand-glass is used by navigating officers when heaving a log, a 28 seconds and 30 seconds glass being most commonly used. See *Knot*.

SCAFFOLDING—the temporary framework built around the sides and ends of the hull while on the shipbuilding ways, on which platforms or stagings are laid for the support of workmen and their tools.

SCAFFOLDING-POLE (SCAFFOLD-POLE)—the uprights used to hold up the scaffolding-planks, temporary platforms or stagings for the support of the workmen and their tools.

SCANTLINGS—a term applied to small-dimension timbers, planks, etc.; all small joists under five inches square are called "scantling," while all joists above that size are generally called "carlings."

SCARF (SCARPH)—the lapped joint connecting two timbers or planks together, made by beveling, notching or otherwise cutting away the sides of two timbers at the ends and bolting or strapping them together so as to form one continuous piece. Usually when assembled the joint or scarf is without increase of thickness. In building a scarf every endeavor should be made to get as near the same strength out of the scarph as either of the timbers joined would show. There are different kinds of scarfs, such as plain, flat, hook, lock, keel, doweled and keyed with treenails.

SCARFING (SCARPHING)—the process of letting in or assembling one piece of timber or plank into another, with a lap in such a manner that they may both appear as one solid uniform surface. When timbers cannot be secured of sufficient size or length it is the common practice to scarph them together in order to build them up to a desired size or length. Keels, keelsons, ceiling, waterways, planks, shelves, stringers, deck beams, girders, and many of the very long continuous timbers in a ship's frame are scarfed together.

SCHOONER—a fore-and-aft rigged vessel; that is, a vessel carrying fore-and-aft sails only, although some vessels on the west coast are built with a yard and square sail on the foremast. This rig is common where the prevailing winds blow steadily for several days from one direction. A fore-and-aft rigged vessel may have from two to seven masts. A fore-and-aft rig is economical in the number of crew required for a given sail area, as there are not so many spars or so much rigging, heavy hauling or gear to be handled or maintained.

SCOREDAP—a groove that is cut in the side of a block for a strop to fit into; a groove cut into the side of a frame to receive iron straking.

SCOTCHMAN—piece of wood or leather placed on standing rigging to prevent excessive chafing.

SCRIBE—to mark or cut with a sharp-pointed knife; to use a race or rasing knife.

SCRIEVE BOARD—a large section of floor in the mold loft, on which the lines of the body plan are scribed or cut with a knife. Molds and patterns of the frame, beams, etc., are sometimes laid out on a scrieve board.

SCRIEVE KNIFE (RACE KNIFE)—a tool having a very narrow U or V shaped blade, used for scrieving, cutting or markng on the face of a timber or plank.

SCUPPER—pipes let through the ship's sides from the deck. In ocean-going vessels these are generally made of lead. Scuppers are used to convey surplus water from the decks overboard.

SEAM—the opening or joint between planking or decking, or between two adjoining pieces of timber.

SEASONING—a term applied when a ship is kept standing a certain length of time after she is completely framed and dubbed off for planking. It used to be the custom to allow a vessel to stand at least six months on the ways when circumstances would permit. It is well known that timber, if cut down one year, sawed and not used until the next season, it is not so liable to shrink, nor liable to be subject to conditions of rot.

SEARCH—the process of locating a leak in a calked seam.

SEATING—that part of the vessel's floor which fays on the deadwood; that part of a transom which rests against the stern-post.

SEIZE—the method of tying or winding small stuff, marlin or spun yarn around a rope to prevent it from untwisting or to prevent rope from wearing at points where it is liable to chafe.

SEIZING—is also a term describing the method of securing two pieces of rope or ends together, by passing a lashing of small stuff, marlin or spun yarn around several times and securely uniting the two pieces of rope the end of which lap, by fastening the ends of the small stuff, so that they can't unwind.

SEIZINGS—is a term applied to finished work. The different kinds of seizing are named according to their position and use as throat, round, eye, shroud, etc.

SELVAGES—rope yarn or spun yarn marled or braided, and used as a strop.

SENDING (SCENDING)—a term describing the act of a vessel pitching violently into the hollow or intervals between the waves in a heavy sea.

SENNIT—rope or spun yarn braided into different forms. There are several kinds of sennit, known as flat, French, round and square.

SERVE—the act of covering a rope or spar by winding a continuous length of small stuff, marlin or spun yarn around it, and securing it at frequent intervals, so that it will not unwind if chafed through.

SERVICE—a term indicating that a rope or thing has been served.

SETTING OR SETTING TO—the act of making a plank or timber fay up close to other timbers by wedges or the use of a wrain-staff; "to set" or "set away" during this operation means to exert more strength in order to pull the member into position. The power applied, either mechanical or otherwise, is called "a set." Many devices are used to accomplish this. Temporary ring-bolts are sometmes set into holes bored into the frame, and wrain-staffs, cleats, lashings or clamps are applied to force the timber or plank member into position.

SETTING-UP RIGGING—to tighten up the shrouds and stays by the aid of purchase tackle, handy billy, turnbuckle, or other mechanical device.

SET-UP—the process of tightening a standing part of tackle, shroud, ratline or stay.

SHACKLE—a U-shaped forging, which is closed across the points by a removable bolt. This bolt is either secured firmly in place by screwing in the threaded end, or the bolt is made long enough to have a small transverse hole through the shackle and the bolt. Into this hole is driven a small key or cotter pin, thus securing the bolt in place. When a bolt is inserted in this hole a detachable link is formed. Shackles are used to connect two pieces of chain together or to make a permanent attachment of a tackle-block to anything instead of using a hook.

SHACKLE BAR—a lever bar with a special length of chain or other device near its end, used to draw out wedges, spikes, bolts, etc., when it is necessary to use force to remove them after being driven into place.

SHAFT—a long, round, heavy forging, sometimes made hollow, usually made in several convenient lengths, connected by flanges or bolts. The shaft delivers the power of the engine to the propeller or to any other mechanical device.

SHAFT LOG—the timbers in the deadwood forward of and fastened to the stern-post, which are bored out a suitable size and through which the tail-shaft passes.

SHAFT TUNNEL—an enclosed alleyway in the after hold, through which the shaft runs. This tunnel extends from the engine-room bulkhead to the stern of the ship at the forward end of the deadwood.

SHAKEN (SHAKEY)—a natural defect in a plank or timber. This condition is indicated by splits or clefts in the face. When a timber is much shaken it is practically impossible to fasten or calk it properly.

SHEAR—to cut off, as to sheer a beam or rivet, with power or other mechanical device.

SHEATHING—a covering of metal or wood fastened over the hull planking as a protection from the attacks of the teredo or other destructive seaworms. Hulls are sheathed in several ways; the methods in most common use are as follows: Sheathing with copper. The bottom planking is cleaned and painted, then paper or other membrane covering which has been dipped in tar, creosote, or any antiseptic which is suitable. This paper is then covered with thin sheets of copper nailed in place. Sheathing with wood. The bottom planking is prepared and covered with paper as described above. Cover this sheath with wood about ⅞" thick, using pine, fir or other suitable material, which has been thoroughly impregnated with creosote or other antiseptic oil. The sheathing of copper or wood covers the entire bottom of the hull and extends up on the sides to the load water line.

SHEAVE—the wheel or pulley in the mortise of a tackle-block over which the rope runs.

SHEAVE-BLOCKS—the tackle commonly known as blocks or tackle-blocks; tackle-blocks have more than one sheave.

SHEAVE-HOLE OR MORTISE—the open space or hole between the cheeks or shell of a block through which the rope runs, and in which the sheave is located.

SHEAVE-PIN—the pin or shaft on which the sheave revolves.

SHEEP-SHANK—a rope knot; a quick method of knotting used by riggers to shorten a rope temporarily.

SHEER—the fore-and-aft curvature of a deck.

SHEER-PLAN—a plan or drawing used in ship construction which shows the side elevation of a vessel, rail, plank sheer, outlines of stem and stern, keel and overhang. The water lines on these plans always appear as straight horizontal lines. The frame lines always appear as straight vertical lines.

SHEER POLE—a bar of metal or wood that is seized across the shrouds just above the upper deadeyes or the top turnbuckle. The sheer pole keeps the shrouds spread in their proper location if they are slacked, and also acts as the first step or ratline in the ladder up the shrouds.

SHEERS—two spars that are raised almost perpendicularly, their upper ends lashed together and their lower ends firmly set and spread apart to give stability; they are usually supported in position by guys or a stiff-leg strut at the back; a suitable purchase tackle is secured to the upper lashing or intersection of the spars. This rigging is very handy and can easily be assembled and erected, and is often used in lifting masts and heavy weights.

SHEER-STRAKE—the upper strake of the hull planking, generally located just below the bulwarks.

SHEET—with fore-and-aft sails without booms, a rope running from the junction of the leach and foot, on boom sails from the outer end of the boom to suitable tackle or cleats on the deck. This rope controls the angle at which the sail or boom lies across the deck, thus enabling the sails to be adjusted at any desired angle.

SHEET-ANCHOR—the anchor that is carried in the waist of a ship.

SHEET-BEND—a handy bend or rope knot used by sailors and riggers.

SHEET-METAL WORKER—a man who works and fits sheet metal weighing up to about five pounds to the square foot; he makes the smoke-stack, ventilator cowls, light metal tanks, light sheet steel wire mesh and locker work.

SHELF—a horizontal timber girder extending along the inside frames of a vessel under the deck and hold-beams. The purpose of this girder is to stiffen the hull and support the deck-beams.

SHELL—the case cover or outside of a tackle-block.

SHELL-FLANGE—the outward turn or flange of the shell of a steel block. This flange protects the rope and prevents cutting it on the sharp edge of the steel shell of the block.

SHELTER-DECK—a light deck, under which the space is partially or wholly closed at the sides, but more or less open at the forward or after ends.

SHIM—a thin strip of wood used to make up a deficiency between two timbers or things which do not fit perfectly.

SHIP—a large sea-going vessel; a term applied to vessels regardless of whether they are propelled by sails or mechanical power. There are many kinds of ships, generally known by the duty they perform or physical characteristics of their build or rig. Sailing vessels can roughly be termed those vessels which are propelled by the power derived from their sails; steam vessels are those vessels propelled by steam power, although they may also have sails as auxiliary power. Motor ships are those propelled by some other mechanical motor power than steam, as internal combustion engines or electrical motors.

SHIP'S CARPENTER—a skilled mechanic who does the framing, wooden timber work, ceiling, planking, and lays the deck of a ship or vessel. This work is generally considered a special trade, although house carpenters who have been well trained and understand theory and practice of their profession, with proper instruction can be made competent ship's carpenters in a very short time.

SHIP JOINER—a man who does cabinet-making, inside finishing in and around the cabins and deck houses; a very high-grade carpenter.

SHIPSMITH—a high-grade blacksmith; a man who forges the chains, fittings, davits, bands and special forgings of a vessel or ship. This work calls for the highest class of artisan.

SHIPWRIGHT—a ship's carpenter; the work of the shipwright is the most varied of any of the shipbuilding trades and may be roughly divided into two classes: (a), *carpentry* or *woodwork*, calling for fabricating skill and knowledge of woodworking possessed by the carpenter, such as the building of scaffolding, building cradle and launching ways, laying wood decks, installing ceilings, planking, etc.; and (b), *erecting* or *millwright work*, such as horning frames, lining and installing stem and stern-posts, laying off for and installing deck fittings, fairing frames, keeping the ship fair or square upon the shipbuilding ways. *Sparmaking*, *boatbuilding* and *calking* are other special classes of millwright work, and are done by special gangs or men. *Inside* work, such as the building of stairs, lockers, berths, paneling and inside finish in the cabins, salon, etc., are not done by the shipwright but by the ship joiner.

SHOE—a piece or pieces of hardwood set under scaffolding poles, heels or bottoms of gin and sheer-poles or under the fluke of an anchor when stowed on deck. When used to support scaffolding, gin, sheer-poles, etc., its purpose is to increase the bearing area on *the* ground and prevent the pole digging or settling down and injuring the stability of the structure. The oak or other hardwood protecting strip under the keel.

SHOE-BLOCK—a tackle-block having two sheaves, which are set at right angles to each other, one being horizontal and the other perpendicular.

SHORES—the timbers used to brace or support the hull during construction.

SHORT-SPLICE—a method of splicing or joining together a rope so that all of the strands are united or braided in nearly the same location. A short-splice is never made on any piece of running rigging, as the splice will not render or pass through the mortise of the tackle-block, due to the fact that the diameter of the splice is larger than that of the pieces of rope which were spliced together.

SHOULDER BLOCK—a block that has a projction on one end, to keep it in place.

SHOULDER-OF-MUTTON SAIL (LEG-OF-MUTTON SAIL)—a triangular sail for a small ship's boat.

SHOWELL—the forward extension of the cradle or sliding ways, which is bolted fast to the ground ways. This prevents the movement of the ship down the launching ways while launching preparations are under way. When the ship is ready to launch the showells are sawn in two; this releases the cradle and the vessel slides down into the water.

SHROUD KNOT—a rope knot put into a shroud to join it together when it has been parted.

SHROUDS—stays which brace the masts, leading from the channels just below the bulwarks up to or just under the mast-head. Shrouds are set up taut by the lanyards rove through the deadeyes attached to the lower end of the shrouds and channels or by turnbuckles attached to the lower ends of the shrouds and to the channels.

SIDE CURTAINS—canvas screens that extend from the ridge ropes or awning ropes stretched between the awning stanchions, to the rail. These curtains are used to keep the weather, rain or spray off the deck.

SIDING (SIDES)—the size or dimensions of timbers; the act of dressing timbers to the correct size.

SIDNEY—the thickness of a timber; also the act of dressing timbers to create breadth and sizes.

SIGNAL-HALYARDS—the halyards that reeve through a dasher block or through holes in the trucks in the top of the mast or any other convenient place and which are used to hoist signals or flags.

SILL—a horizontal member forming the foundation or part of the foundation of a structure of any kind. When applied on shipboard, it is the lower or foundation member attached to or set into the deck.

SINGLE BLOCK—a block containing one sheave.

SINGLE DIAMOND KNOT—an ornamental rope knot worked with strands of rope and used as a finish on manropes, etc.

SIRMARK (SURMARK)—a mark upon the mold of a frame timber or plank indicating where beveling is required.

SISTER-BLOCK—a tackle-block that contains two sheaves which are placed one above the other. The shell of this tackle-block has a score around the outside at the middle between the two sheaves, to receive the becket, gromet or strop by which the block is attached to anything.

SKYLIGHT—an opening in the deck to give light and air to the compartment below, fitted with a removable or hinged cover with glass lights.

SLABS—pieces of wood fitted between whelps.

SLEEPERS—the knees that connect the transom to the after timbers at the quarters in the hull.

SLING (STRAP; STROP)—the iron or steel chains or a length of rope with its ends spliced together, used as a means of handling cargo. Slings are used around boxes or bales which it is intended to hoist or lower into the hold. The two bights are brought together and one bight is passed through the other, then attached to the hook. A strain is put upon the lifting rope, or fall, the sling is then drawn tight so that the boxes or bales are wedged firmly together and cannot slip. By this means many packages can be handled at one time.

SLIP—a foundation of transverse timbers laid upon the ground or upon pile foundations; upon these timbers the vessel is built. These timbers are also used as a foundation to erect the sliding ways under the vessel, after she has been constructed, upon which she is launched into the water.

SLIP-KNOT—a rope knot.

SLIPPERY HITCH—a rope knot formed of a loop or half bow knot so tied in a rope that it will not jam but will untie quickly by pulling it on the hanging or loose end.

SLIP-ROPE—a rope so knotted that it may be slipped or let go quickly.

SMALL STUFF—a term given to marlin, spun yarn, etc.

SMOKESTACK—the large vertical pipe or funnel used to lead the smoke and hot gases from the boiler furnaces up into the atmosphere. The smokestack is similar to a chimney in a house or power plant.

SNAP—to bevel the end of anything so that it will fay upon an inclined plane.

SNATCH-BLOCK—a block that contains one sheave and has an opening in the side of the shell so that the bight of a running rope may be passed into it. This block is used where it is necessary to change the lead or direction of the rope quickly, as it obviates the necessity of reeving the end of a rope through the mortise of a tackle-block or leader.

SNY—the upward curving of the planking at bow and stern.

SNYING—a term applied to a plank when its edge rounds or is accurately curved upward. The greatest sny occurs in vessels with full bows or buttocks and is only to be prevented by the intervention of steelers in the planking strakes.

SOLE BLOCK OR SHOE—a wide piece of wood on which the heel of gin, scaffolding poles or sheer legs rest. This prevents them from sinking into the ground when they are under pressure and endangering their stability.

SOUNDING—the process of determining the depth of water by the use of a pole, sounding line or machine. In deep water navigation the depth is generally given in fathoms equal to a depth of six feet.

SOUNDING-MACHINE—a special machine for taking deep soundings at sea while the vessel is under way. Such soundings are not taken by measuring the length of line or wire run out, but they are measured by the compression of air in a glass tube which is sealed at one end and is coated on the inside with a special chemical preparation which becomes discolored by contact with the water. This glass tube is placed in a special receptacle on the side of the sounding lead. As the lead sinks to the bottom, the pressure of the water compresses the air in the glass tube and allows the water to enter and come in contact with the coated interior surface of this glass tube. When sounding the operator feels the sounding wire to which the sounding lead is attached with a special steel hook, which he holds in his hand pressing down on the wire as it runs out over the tafrail. As soon as the lead touches the bottom he feels the wire slack. The wire is then reeled

in, the glass tube is taken out of the receptacle and the length of the discoloration in the tube from the open end is measured with a special scale or rule so graduated that the reading given is in fathoms, which is the depth from the surface of the water to the greatest depth that the lead reaches.

SOUNDING-PIPES—vertical pipes running from the deck to the bottom of the hold or to tanks, used for ascertaining the depth of the water in the hold or of oil, water or other liquid in tanks.

SOUNDING-ROD—a graduated rod lowered down through the sounding-pipe until it touches the bottom, and by the immersion of this rod, the depth of water, oil or other liquid which is contained in the tank can be determined.

SPALL OR SPALE—a temporary wooden brace to a timber or frame generally used to keep the correct width or breadth of a vessel's timber frame, while the hull is under construction.

SPALLING (SPALING)—is to fix or brace a timber or frame with spalls.

SPAN—a rope that has both ends made fast, with a purchase tackle hooked at the bight or loop; the length from the deadeyes or turnbuckle of one side of the vessel up over the eyes of the rigging at the masthead and down the deadeye or turnbuckle on the other side of the vessel.

SPANISH BURTON—a peculiar type of purchase tackle. There are two kinds: single Spanish burton, double Spanish burton. See *Burton.*

SPANISH WINDLASS—an extemporized purchase made by attaching a rope lashing made of several parts and inserting a lever in the hitch or bight of the rope. By twisting or passing the lever round and round the lashing, a considerable strain can be produced.

SPAR—a long round or oval timber, as a mast, yard, boom or gaff.

SPAR VARNISH—a varnish of superior quality, not affected by salt water, soap, grease or ammonia fumes, which is used as a coating for spars, and all outside exposed woodwork; also used on any place or wooden thing where varnish of durable quality is required, sometimes called spar composition.

SPECTACLE IRONS—sometimes called spectacle shackles; three-eyed irons used in lashing rigging.

SPIDER—a small iron crane or projection from the side of a mast or bulwark, used to keep a tackle-block clear, so that it will not foul.

SPIDER-BAND—the band of iron or steel around the mast just under the top, to which the futtock-shrouds are secured.

SPILLING—the act of measuring, marking and scribing the contour and beveled edged curve of a planking strake on the ship's hull.

SPIRKETING—a thick strake or strakes wrought inside upon the ends of the shelf or water-ways.

SPREAD—distance at right angles from the center line.

SPRING—to bend a beam, timber, mast or any other thing by force.

SPRING STAY— horizontal manila or wire rope stay which extends from one lower masthead to another lower masthead.

SPRIT—a small staff or spar which extends diagonally from the mast and is used to support the peak of some fore-and-aft sails which are not provided with a gaff and peak halyards. The upper end of the sprit is thrust into an eye in the bolt-rope or a small gromet, and the lower end is fixed into a becket or snotter which is adjustable and is fastened around the mast with a loose end having an eye. This becket can be raised or lowered and thus adjusts the peak at the right height.

SPRITSAIL—a fore-and-aft sail which has its peak supported by a sprit. Formerly a spritsail was a sail suspended under the bowsprit from the spritsail yard; now obsolete.

SPRITSAIL KNOT—a rope knot that is made by weaving or joining the strands of a rope together so that they form an eye.

SPRUNG—anything that is forced or bent out of its original shape.

SPUN YARN—two or three rope yarns twisted or spun together into a cord.

SPURLING-LINE—a small line that connects the tiller or quadrant with a telltale, located on the bridge or point from which the vessel is navigated. The telltale is the mechanical device which indicates the angle at which the tiller stands. This device is of great use to the helmsman in steering a vessel.

SPURS—pieces of timber fixed temporarily to the bilge ways, their upper ends being bolted to the vessel's side above the water. These spurs help support the vessel during launching operations. Also curved pieces of timber serving to support the decks at the hatches where a deck beam cannot run the whole width of the ship.

SPUR-SHORES—a timber or post set slightly diagonally and used to brace or support the hull of a vessel, while on the building ways, against the lateral movement when under construction.

SQUARE FRAME—a frame that sets square or at right angles to the line of the keel.

SQUARE-RIGGED—a vessel that carries yards and square sails on one or more of her masts.

SQUARE-STERN—a vessel the stern of which is almost perpendicular or has no overhang.

SQUARE TIMBER—a term applied to a timber which sets square or perpendicular to the keel.

SQUARE-TUCK—name given to the after part of the vessel's bottom which terminates in the same direction, up and down, as the wing transom. The planks of the bottom end in the rabbet at the foreside of the fashion piece, whereas ships with a round stern or buttock are round or circular, and at the bottom, end upon the wing transom.

STABILITY—the ability of a ship to remain on an even keel or upright position.

STAFF—a light flagpole.

STAGE PLANK—a thick, wide board laid on the scaffolding beams or thwarts to form a platform for the support of workmen.

STAGGER—to arrange in a zigzag way.

STANCHION—a pillar, column or upright post.

STANDARD OR STANDING KNEE—an inverted knee placed above the deck instead of beneath it. The vertical leg of the knee is upright. This knee is used to brace bitts, etc.

STANDING OR STANDING PART—that portion of rope or cable that is secured to something, but is not used for hauling; the part of a hook opposite to the point or shank.

STANDING BACKSTAYS—the stays which are set up abaft the shrouds on each side and which support the topmasts when the vessel is under sail.

STANDING GAFF—the gaffs that are kept throated and peaked aloft, and on which fore-and-aft sails are set by means of an out-haul and furled against the mast by means of brails. Vessels using this rig do not use a boom on the foot of the fore-and-aft sails.

STANDING RIGGING—all the rigging of a vessel, such as stays, shrouds, etc., which are secured permanently in place and are not hauled up and down.

STARBOARD—the right-hand side of a ship when looking from aft forward, as opposed to the left-hand or port side of a vessel.

STARBOARD TACK—when a sailing vessel is under way and her boom and spars are on the starboard side and the wind is coming from the port side, the vessel is said to be on the starboard tack.

STAY (STAYING)—a fore-and-aft manila or wire rope running from the top of the mast-head down to the forecastle deck at the stem or at the foot of the next mast forward; the fore-and-aft manila or wire rope running from the topmast head down to the mast-head of the mast next forward or to the forecastle deck at the stem; the process of bracing a mast sideways and fore-and-aft.

STAYS—the manila or wire rope used to brace the masts or spars extending from another mast or spar or from the head of the mast to the side of the ship or deck. Fore-and-aft stays are stays that lead from the mast or topmast heads forward. The backstays are the stays which lead from the masts or topmast heads to the vessel's sides at the bulwark channels.

STEALER OR STEELER—a name given to the foremost or aftermost plank in a strake which does not terminate at the stem or stern-post. Stealers are used on vessels with very full bows or buttocks, and where the planks have a very large sny.

STEERAGE—the deck of a passenger vessel on which the steerage or third-class passengers live.

STEERING BRIDGE—the bridge on which the steering wheel is placed and from which the vessel is steered.

STEERING-GEAR—the mechanical apparatus for controlling the rudder.

STEERING-WHEEL—the wheel that is connected with the tiller or to the steering engine, by which the vessel is steered.

STEM—a heavy timber forming the extreme bow of the ship extending from the keel to the forecastle deck. The forehood planking terminates at the rabbet and is firmly fastened in place on the stem.

STEM BAND—an iron or metal strap fastened to the front end of the stem extending around over the gripe down on to the under side of the keel shoe. This band is a protection to the stem.

STEMSON—a piece of compass timber, wrought on the after side or the inside of the stem apron, the lower end of which scarfs into the keel or forward deadwood. The upper part is continued high above the water-line to the upper deck, and is used to back up or support the scarf of the apron.

STEP OR STEPS OF THE MAST—a step is a wooden socket in which the heel or lower end of the mast is firmly fitted; generally made of large pieces of hardwood. The step of the foremast is generally attached to the keelson, those of the mizzen and jigger-masts to the lower deck-beams on top of the shaft tunnel. The holes, recesses or mortise in the step into which the tenon on the foot or heel of the mast steps, should be equal in strength to the tenon or fitted projection on the heel of the mast. The mortise in the step should be cut rather less than the tenon on the heel of the mast to allow for shrinkage.

STERN—the after end of a vessel; that part of a hull which is furthest from the stem or bow.

STERN-DAVITS—the davits that project from the stern and on which the ship's gig is suspended.

STERN-FRAME—the combination of strong frame timbers at the after end of the ship, composed of the stern-post, transom, fashion pieces, rudder-post, etc., all of which form the stern supporting structure.

STERN-LADDER—the ladder that is hung over the vessel's stern for use of the gig crew, to get into the boat when hung from the stern davits.

STERN-PORT—a window or porthole in the stern of a vessel.

STERN-POST—a wooden piece secured at its lower end to the after end of a keel, the upper end supporting the transom and the horn timbers. To the stern-post is fitted stern-post knees, deadwood, deck-beams, etc., all this construction tending to make the ship very strong and rigid at this part of the hull. The after-hold planking terminates at the rabbet in the stern-post, and is securely fastened to the deadwood and stern-post.

STERN-TUBE—the metal tube or lining to the hole which is bored through the shaft log and rudder-post for the tail shaft.

STICKS—a name sometimes applies to masts.

STIFF LEGS—struts or straight timbers which brace or support the masts of a derrick.

STIRRUPS—short ropes that have eyes spliced on one end. The other end is seized or lashed to a standing stay.

STOCK—horizontal crosspiece of an anchor; this may be either wood or iron. It is always placed at right angles to the anchor arms or flukes.

STOOLS—small channels which are placed abaft the regular channels on the bulwarks, and to which the deadeyes or turnbuckles for the backstays are attached.

STOP—a fastening of small stuff or canvas tape; a ribband used to secure a sail to a boom or gaff after it has been furled.

STOPPER—a short, handy length of rope, one end of which is secured conveniently near a running rope or hauling part or cable. The stopper is used to check or regulate the motion or speed of a running rope, hauling part or cable by wrapping the loose end several times around the standing part. If a purchase has been used on a winch, hawser or capstan and it is desired to secure it permanently on the bitt or cleat, the stopper is used to hold the strain on the purchase rope until the purchase can be transferred and secured.

STOPPER-BOLTS—the ring bolts located in the deck at convenient points and to which stoppers, hooks or tackles can be attached.

STOPPER-KNOT—a double wall knot on the end of a deck stopper. This prevents the rope from stranding out or unwinding.

STOPPING-UP—a term applied to the poppets and timbers used to fill up the vacancy between the upper side of the cradle, launching or bilge ways and the ship's bottom. This structure supports the ship forward and aft when she slides down during launching operations.

STOPS—short pieces of ropes or canvas tapes used for securing two things together, also used to tie around a sail or awning when it is furled.

STOP-WATER—pieces of soft wood coated with lead and driven tight into grooves cut in between two adjoining timbers. A stop-water is used to prevent water from leaking in and to provide a water-tight joint.

STORES—a shipbuildng and outfitting word, indicating supplies, more particularly applied to expendable supplies and food.

STOW—to put cargo or stores into the ship's hold or into the proper receptacle or compartment of the hold.

STOW OR STOW THE CARGO—the process of placing the cargo in the ship's hull compactly, so that it will not shift when the vessel is in a rough sea.

STRAIGHT OF BREADTH—the space before and abaft the dead flat, in which the ship is the same uniform breadth, and where the bottom commences to rise; that part of a vessel's hull that has vertical sides.

STRAIGHTEN THE SHEER—to give a ship's sheer a curve of longer radius.

STRAKE—a continuous breadth of planking or ceiling, generally running from stem-post to stern-post on the outside of the ship's frame. The process of putting on a strake is called planking.

STRAND—any number of rope yarns twisted together, forming a strand; several strands twisted in the opposite direction form a rope.

STRAP—a length of rope, the ends of which are spliced together so as to form a ring or continuous length of rope. Straps are used for handling cargo or for attaching a tackle to any object. See *Sling*.

STRAPPING—narrow steel or iron bands fastened diagonally in both directions to the outside face of the wooden frames of a wood ship. The purpose of strapping is to stiffen and strengthen the frame structure of a vessel.

STRENGTHENING PIECES—extra pieces of canvas which are sewed in the corners of sails or awnings, also at the cringle or along the luff. These reinforce or strengthen the sail or awning at these points.

STRINGER—a strake of planking around the inside of a vessel close to the under side of a beam, sometimes located over the stanchion running fore-and-aft and forming at the hatch openings the bottom side of the hatch coaming.

STROP—a binding of rope which encircles and is fitted into the score or groove on the outside or shell of a tackle-block. The strop is made long enough so that an eye can be formed in the drift end. This eye is made by seizing the rope below the bight in such a manner that the strop is forced tightly into the score. It is used to support the tackle-blocks. Modern or manufactured blocks are usually made with iron strops, either fastened outside the block or extending along the sides of the mortise to the point below the sheave-pin. In this type of block the strain on the sheave-pin is carried on the strop, the shell being only a protection for the sheave.

STRUT—a compression member or brace, as a column, either horizontal, diagonal or vertical; a V-shaped bracket which supports the outboard beaming, stem end of tail-shaft and propeller. The beaming is attached to the apex of the V, and the two legs are securely bolted to the hull of the ship at one of the cant or half-frames.

SUPPORTERS—long timbers under the cat-heads.

SURMARK—see *Sirmark.*

SWALLOW—that part of the mortise or opening in a tackle-block through which the rope is rove when passing over the sheave.

SWASH CHOCKS—see *Blow Chocks.*

SWIFTERS—the forward shroud on each set of shrouds, attached to the lower mast on the port and starboard sides, are called "swifters"; also the length of rope employed to keep the capstan-bars in place.

SWIVEL—a metal link turning or revolving upon an axis; it is used on chains or cables or on long lengths of wire rope. The purpose of the swivel is to keep the twists, turns or kinks out of rope, chain or cable. Swivels are also fitted on iron-bound blocks and on hooks.

SYPHERING—the process of wrapping the edges of planks over each other, as in bulkhead construction.

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TABLING—a tenon on one piece of timber or scarph fitting snugly into a corresponding mortise in another; also the hem on the borders of sails to which the bolt-rope is sewed.

TACKLE—a purchase of ropes and sheave or tackle blocks.

TACKLE BLOCKS—a term applied to the sheave blocks which go to make part of a purchase tackle.

TAFFEREL (TAFFRAIL)—the bulwark rail or fence across the stern of a vessel which forms the upper part of a vessel's stern, usually ornamented with carved work or molding.

TAFFRAIL LOG—a mechanical device which is attached to the taffrail at the stern of the ship and is used in connection with a small bronze propeller which is towed astern. The rotation of this propeller operates the mechanism inside of the taffrail log and gives accurately the number of knots which the ship is traveling. Some taffrail logs also have a pointer or indicator for the speed of the ship at the time the reading is taken. This mechanism is somewhat similar to the speedometer on an automobile.

TAIL—a vessel at anchor tails up or down stream according to the way her stern is turned.

TAIL-BLOCK—a tail-block is a purchase block with a very short length of rope joined on to the strop, or grummet, fitted around or secured on the block. This rope takes the place of the hook or shackle on the block.

TAIL-ROPE—is a short length of rope which is attached to the strop of a tail-block; also a loose end of rope or the loose hauling part of a tackle.

TAIL-SHAFT—the extreme after section of the propeller shaft which passes through the shaft log and the stern-post. Inboard the forward end is flanged and secured to the line shaft, which is in turn connected with the thrust shaft and main engine crank shafts. The outboard or after end is fitted with a keyway and on this end the propeller is secured. The power developed by the engine is transmitted through the crank, thrust, line and tail-shaft to the propeller.

TAIL-TACKLE—a watch tackle purchase, which has a tail-rope attached to the strop of one of the tackle-blocks.

TANK—an iron, steel or wooden receptacle for storing fresh water or other liquid.

TANNED SAILS—sails that have been soaked in an oak bark solution to preserve them from mildewing.

TAR—the residual gum from the distillation of turpentine, made from pine trees. It is used on standing rigging, to pay seams, and as a general protection to anything from the elements.

TARPAULIN—a painted or prepared canvas. The painting or preparation applied makes it waterproof and wearproof.

TASTING (OF PLANKS OR TIMBERS)—the process of chipping a plank or timber with an adze or boring it with a small auger for the purpose of ascertaining its quality or defects.

TAUNT—extremely tall or high masts are sometimes spoken of as taunt masts. A vessel is said to be "all-a-taunt-o" when she has all her masts and yards aloft, sails bent and rigging in order, ready to go to sea.

TAUT—a rope is said to be taut when it has a strain upon it, and is straight and tight.

TEACH—a term applied to the direction that any line, etc., seems to point out. "Letting the line or mold teach fair to such a spot, raise, etc."

TELEGRAPH BLOCK—this is a tackle-block with a long, narrow shell, in which are a number of small sheaves, and through these sheaves are rigged the several signal halyards.

TELLTALE—the mechanical device which indicates the angle at which the tiller stands. This device is of great use to the helmsman in steering a vessel.

TELLTALE COMPASS—an inverted card compass hung from one of the deck beams or carlins in the captain's cabin or other desirable location. By this means one can look at the card and see that the vessel is headed in the right direction or course without going up on the bridge and inspecting the binnacle compass.

TENON—a projection at the end of a timber shaped and fitted so as to be inserted tightly in a mortise which is cut in another timber, thus making a firmly fixed joint; also applied to the shoulder or projection of the heel of a mast which fits into the steps or mortise attached to the ship's keel or keelson, partners, head-beams, etc.

THICK AND THIN BLOCK—a block that has two sheaves, one thicker than the other, so as to accommodate different diameters of ropes passing through the block and over the sheaves.

THICK STUFF—a name for sided timber exceeding four inches, but which is not more than twelve inches in thickness.

THIMBLE—an iron ring with a groove around its outer rim for a rope strop or grummet to fit into, so that it will remain in place when the rope strop or grummet is lashed or spliced into an eye. Thimbles are sometimes spliced into the bolt rope at the corner of a sail or awning, and used as a cringle or for a similar purpose. Thimbles are put in the eye-splice at the end of a pennant. The purpose of the thimble is to prevent the eye-splice from chafing or wearing out.

THREEFOLD BLOCK—a tackle-block containing three sheaves.

THREEFOLD PURCHASE—a purchase tackle which is made up of two blocks containing three sheaves.

THROAT—the inside of knee timbers at the middle or turn of the arm; also the midship part of floor timbers; the upper forward corner of a fore-and-aft sail formed by the luff and head.

THROAT HALYARDS—the halyards which hoist the inner end of the gaff or luff of the fore-and-aft sails, or that part of the sail which is against the mast.

THROAT SEIZING—the seizing or lashing made at the throat of a sail when attaching it to a halyard or gaff or to the mast.

THRUM—a thatch or mat made of rope ends or canvas, sewed to sails or lashed on a rigging, to prevent chafing.

THRUMS—short strands of rope or shreds of canvas which are obtained by cutting old rigging, sails or gear into small pieces and then unlaying the strands or unweaving the canvas; from this material a thrum or thrum-mat is made.

THRUST SHAFT—the next length of shaft abaft the main engine or connected to the after end of the crank shaft. This shaft has collars forged upon it which are faced and fitted into a thrust bearing. These collars take the entire thrust of the propeller when forcing the ship ahead or astern.

THWART—a small, horizontal wooden beam supporting scaffolding on which the sagging plank is laid; also the cross seat in an open boat; the cross timber or cap of the ground ways supporting the keel-blocks, cribbing and shores; the capping of pile foundation to the ground ways.

TILLER—the bar of iron or wood which is attached to the forward side of the rudder-head or stock, and takes the place of the rudder quadrant. By swinging this bar transversely the rudder is turned at any desired angle with the keel.

TILLER BOX—the protecting box over the tiller.

TILLER-HEAD—the end of the tiller which is farthest away from the rudder-head or stock.

TILLER-ROPES—the ropes or chains which lead from the tiller or rudder quadrant to the barrel of the steering-wheel.

TILLER OR RUDDER TELLTALE—a small arrow on top of the tiller box; this arrow indicates the position of the tiller and rudder in reference to the keel at all times.

TIMBER—a term used for all pieces of wood of any importance employed in the construction of a vessel, but particularly to those pieces which form the frames; the principal pieces of wood forming a ship's structure.

TIMBER-HEADS—the ends of the timber frame or top futtocks which project above the deck and are sometimes shaped into bitts, which are used for belaying or securing hawsers, etc.

TIMBER-HITCH—a rope knot that is used for attaching a loose end or the standing part of a rope to a timber or other objects.

TIMBER-PORT—a port-hole provided with a water-tight door, cut in the bow of a vessel above the water-line, and close to the stem, or in the stern of a vessel in under the counter; used to handle long timbers or other long, narrow and awkward cargo in and out of the ship's hold.

TIMENOGUY—a rope stretched from one point to another for the purpose of preventing gear, such as ropes or chains, from fouling. On sailing vessels it is carried from the stock of the waist anchor to the forward rigging and is used to prevent tacks or sheets from fouling with the stock of the anchor.

TOGGLE—a wooden or metal bar employed to connect two ropes or a rope and some other object. The toggle it attached in the middle by lashing or splicing it to the end of a rope. In attaching the toggle to another rope or thing, the toggle is slipped through the rope eye, bight or becket formed in the other rope or through the hole in anything which it is desired to move and set across the eye or opening. Bowlines are sometimes fastened to bridles and ring buoys by this method; anything attached with a toggle can be let go or detached quickly if necessary.

TONGUE—a vertical, pivoted block of hardwood that is fastened between the jaws of a gaff or boom and which forms the bearing surface for the end of a spar against the mast. The tongue is pivoted to a pin which is driven transversely through the jaws of the gaff or boom. This allows the face of the tongue to be parallel to the side of the mast no matter what angle the gaff or boom sets.

TONNAGE—the freight carrying capacity of a vessel expressed in tons. See Gross and Net Registered Tonnage.

TOP—a platform at the head of a lower mast which is supported on the trestle trees. The top is used to give spread to the topmast rigging, and in square or lofty rigged sailing vessels is of considerable size.

TOP AND BUTT—an economical method of working or laying long tapering oak ship planking so as to make a good conversion; as oak or other hardwood planks are liable to run very narrow at the top, the method of laying is as follows: locating the top end of every plank within about two frame spaces of the butt end of the plank above or below it and letting every plank work out as broad as it will hold clear of sap. By this method only can every other seam produce a fair edge.

TOP-BLOCK—a large tackle-block through which the top rope reeves when sending up and down the topmast.

TOPGALLANT OR FORECASTLE DECK—a small deck built level with the rail at the extreme forward end of the ship.

TOPGALLANT MAST—the mast next above the topmast.

TOPGALLANT RIGGING—the shrouds and ratlines which belong to the topgallant mast.

TOPGALLANT SHROUDS—the shrouds that brace the topgallant mast.

TOP-HEAVY—when the top part of a thing is too heavy for the lower part and it tends to overturn it, it is "top-heavy."

TOPMAST—the second mast above the deck, or the mast which is next above the lowermast. They are named according to their location, as fore, main and mizzen topmast.

TOPMAST RIGGING—the shrouds and ratlines which brace the topmast.

TOPMAST SHROUDS—the shrouds which brace the topmast.

TOPPING—the act of raising one end of a spar higher than another. Topping the boom or topping the gaff is to raise or pull the outboard end of the spar above the end against the mast.

TOPPING-LIFT—the purchase tackle used for topping or lifting the outer end of a boom and sustaining its weight and anything that may be suspended from it.

TOPSAIL HALYARD BEND—a rope knot or bend made around a spar or timber.

TOPSAIL SCHOONER—a fore-and-aft rigged vessel that carries a square sail and spreads yards on the fore topmast; a square sail is sometimes carried on the foremast below the square topsail.

TOP SIDES—generally referred to as the sides of a ship above the water-line.

TOP TIMBER LINE—the curve limiting the height of the sheer at the given breadth of the top timbers.

TOP TIMBERS—the timbers which form the top side. The first general tier of timbers; the uppermost futtocks which reach the top and form the bulwark stanchions, are called "long top timbers," and those which terminate at the deck are called the "short top timbers."

TOUCH—the broadest part of a plank worked up top and butt, which place is at least two frame spaces from the butt end; the middle of a plank worked anchor-stock fashion; the sudden angles of the stern timbers at the counter.

TRAIL-BOARD—in shipbuilding one of the two curved pieces which extend from the stem to the figurehead; it is fastened to the knee of the head. Trail-boards are not seen on vessels with straight stems and are now practically obsolete.

TRANSOM—the athwartship timber, structure or frame at the after end of a vessel's hull framing which is bolted to the stern-post and shapes or forms the buttocks, the curves of which are shown on the horizontal or half-breadth plan of the ship. A term sometimes applied to the bench or seats in the cabin, saloon or state-room, which have lockers or storage-room under the seat.

TRANSVERSE—a term meaning athwartship, or at right angles to the keel.

TRANSVERSE LINE—a right or curved line which cuts transversely another system of right or curved lines running in another direction.

TRAVELER—a loose ring which slides along the traveling bar, deck horse, along or up and down the standing part of a rope.

TREAD OF KEEL—that part of a vessel's keel which is a straight line. In vessels with a cambered or sagged keel this would be, of course, only approximately straight.

TREBLE-BLOCK—a threefold block; a tackle-block with three sheaves.

TREENAIL—a round or octagonal piece of hardwood driven through the frames, timbers and planking of a vessel, to fasten or connect them together. They are usually made of locust, live oak, iron bark, bois d'arc or sage orange. They should be made of very tough, sound wood, cut near the butt and perfectly dry or well seasoned. When driven into place they should be wedged on the outside with small hardwood wedges. This wedging prevents the planks or member in which the treenails are driven from becoming detached, and also spreads the end of the treenail and makes it water-tight.

TRESTLETREE—one of the two strong bars of timber fixed horizontally fore-and-aft on the opposite sides of the lower masthead. The trestletrees support the framework of the main top and the topmast. When attaching to the top masthead they support the topmast across trees and topgallant mast.

TRIATIC STAY—a wire or hemp stay or rope, which is secured to the head of the topmasts of fore-and-aft vessels and leads aft to the lower masthead of the next mast aft. These are additional fore-and-aft stays to the topmasts.

TRICE—to haul up and secure anything, as the heel of a boom, clue of a fore-and-aft sail, etc., "trice up the boom."

TRICING LINE—a small line with which anything is triced up.

TRIM—the amount a ship is off even keel or down by the head or stern, as "she trims by the head or stern."

TRUCK—a circular or spherical shaped piece of hard, tough, fine-grained wood, such as lignum vitæ, which is placed at the extremity or the highest point of a mast, where topmasts or topgallant masts are used; it is only at the highest point of the highest mast. The truck is a protection to the end of the timber in the masts, preventing moisture from getting in and rotting the end fibres, is ornamental and is also useful; it is fitted with small holes, and sheaves are provided, through which are rove the signal halyards.

TRUNK CABIN—the name given to the cabin or compartment used for living quarters, which is half above and half below the upper deck.

TUMBLE HOME—the sloping in of the vessel's topsides above the point of greatest beam.

TUCK—the after part of a ship where the ends of the planks in the bottom terminate at the tuck-rail, also known as all that part of the ship's bottom below the wing transom, where it takes the shape of the wing transom as far aft as the fashion piece.

TUCK-RAIL—the rail which is worked on to the upper side of the wing transom, forming a rabbet which provides for the calking of the butt or hood ends of the bottom planking.

TURN—to turn or twist a rope or chain around a cleat, belaying pin, bitts, mast, bollard, yard or spar, for the purpose of fastening or securing, is called "catching," "catching a turn" or "taking a turn"; to turn in a deadeye is to strap it around or secure it to the end of a shroud; to turn the glass is to turn the sandglass over so that the sand will start running and indicate a certain interval of time. This is done when heaving a log.

TURNBUCKLE—a mechanical device made of iron or steel, consisting of a double nut with two eye bolts, one threaded right-hand and one threaded left-hand. When the nut is revolved in one direction it tends to bring the two eyebolts together, when revolved in the opposite direction it tends to force the two bolts apart. This device is used for setting up standing rigging, and when used, the shrouds or stays can be set up very tight and great strain or pressure can be created. The turnbuckles are replacing deadeyes and ratlines on modern rigged vessels.

TURN OF THE BILGE—the curved part of the ship's bottom, the outside joining of the ship's sides with the flat of the bottom.

TURN OF FLOOR—ships are often built without double bottoms. Where the edge of the floor curves up around the bilge to the vertical side frames, this curved part is called "turn of floor."

TURTLEBACK—a covering which decks over the extreme forward or after part of the upper deck on many vessels. The turtleback commences at the bulwarks rail and rounds up aft or forward, as the case may be, towards the midships. From its similarity to the back of a turtle it derives its name. The turtlebacks are a great protection to the vessel in heavy weather.

'TWEEN-DECKS—between decks; the space or deck between the lower and upper decks, used as storage place for cargo.

TWICE-LAID ROPE—a rope that has been laid up from old yarns.

TWOFOLD BLOCK—a tackle-block that has two sheaves; a double block.

TWOFOLD PURCHASE—a purchase tackle that has two double blocks.

TWO HALF HITCHES—a useful rope knot often used as a mooring hitch on a hawser.

TWO TOPSAIL SCHOONER—a schooner having square topsails on fore and main topmasts.

TYERS—short lengths of rope, which are used for tying or securing a sail; they take the place of gaskets.

U

UNDERFOOT—when an anchor is hanging directly underneath the hawse pipe it is said to be underfoot.

UNDERMASTED—when the masts are either too slender or too short for the vessel, it is said to be undermasted.

UNFURL—to untie or cast loose a sail or awning; to take off the gasket or stopper.

UNREEVE—to withdraw a rope from over the sheave of a tackle-block.

UNSHIP—to remove a thing from a place in which it is customarily fitted or secured.

UP AND DOWN—anything that is in a perpendicular position, as when the yards are canted against the mast when laying alongside the dock, they are said to be up and down.

UPHROE—see *Euphroe.*

UPTAKE—the flue or connecting-pipe between the boilers and smokestack.

UPPER WORKS—the sides of a vessel from the water-line to the covering-board.

V

VANE—a pennant, also called "fly"; a small flag or metal device which is supported on a spindle and revolves in a horizontal plane. With this device the direction of the wind is accurately indicated.

VANGS—ropes for steadying the outer end of the peak of a gaff or boom. These are secured at the point of the spar and lead down to the rail on each side.

VEER AWAY—to move away to one side, or to put out a little more rope or line.

VENTILATOR—a device for furnishing fresh air to the compartments below the decks of a vessel.

VESSEL—a hollow receptacle of any form or material. A ship or craft designed to float on the water, usually one larger than an ordinary rowboat, as a merchant vessel, steam vessel, etc. Legally, water craft or floating structure. By the Revised Statutes of the United States, "vessel" includes every description of water-craft or other artificial contrivance used or capable of being used as a means of transportation on water. A raft of logs, however, has been decided not to come within the intent of the law. See *Ship.*

VOICE TUBE—a speaking-tube which leads from the bridge, chart or pilot-house of a vessel to the engine-room; this is for the purpose of transmitting orders to and from the bridge.

W

WAIST—the low portion of the upper deck between the forecastle and the bridge deck and between the bridge deck and the quarter deck.

WAKE—a term indicating following in the same line; the track of foam eddy or disturbance of the water to be seen after a vessel passes. A ship is said to "follow in the wake" of another when she follows in the same track; to "cross the wake" of another when she crosses the course in which the other has passed.

WALES—thick strakes of outside planking worked in along the sides of a vessel about midway between the plank sheer and the light water line. The breadth of the wales is from one-fourth to one-third of the vessel's depth. The wales stiffen the vessel and also form rail strakes on the outside.

WALL-KNOT—an ornamental rope knot worked in on the end of a rope as a finish and to prevent stranding.

WALL-SIDED—a term applied to the top sides of a vessel when the main breadth or square body is continued very low down and high up, so that the top sides appear straight and vertical like a wall.

WASH-BOARD—a vertical strake around the coaming of a cockpit of a small-decked vessel, used to keep the sea from washing over or into the cockpit.

WASHER—a flat perforated metal plate used under the bottom edge of nuts or bolts; the washer prevents the sharp edges of the nut from cutting into the wood or metal.

WATCH-TACKLE—a purchase tackle that is formed of a double and single block. The single block is generally provided with a hook and the double block has a rope tail. This sort of tackle is sometimes called a jigger, also a handy billy.

WATERING A SHIP, VESSEL OR HULL—to pour water down between each frame inside in order to test the water-tightness while she is still on the shipbuilding ways. By this method the character of the workmanship can be seen, as leaks around fastenings or seams will quickly be discovered.

WATER-LAID ROPE—a name that is sometimes applied to a rope that is laid up right-handed, like a cable rope.

WATER-LINES—lines of flotation; these are horizontal lines intended to represent the surface line of the water on the sides of a ship. On the sheer draught plan they are indicated at certain depths. In half breadth plans these water-lines show as curved lines. There are two important water-lines used when the vessel has been constructed. The light water-line is the line which represents the surface of the water when the ship is light or unloaded, without stores or cargo; the load water-line is the line representing the surface of the water when the ship is loaded with her stores and cargo, and if she is an armed vessel, also with guns and ammunition.

WATER-TIGHT—a term applied to indicate that a vessel has been constructed, fastenings put in, and her seams calked, so that she does not leak or any water work in through the sides into the hold.

WATERWAYS—horizontal timber girders carried along the inside of the hull at the deck line. The waterways rest on and are locked and fastened to the deck beams. This term is also applied to the edge of the deck next to the waterways. The construction at this point forms a kind of gutter, from which the scuppers lead out to the side overboard. The water on the deck of a vessel is generally drained off by the waterways and scuppers, except in heavy weather, when the sea boards the vessel. At such times the greater part of the water is carried off through freeing ports cut in the bulwarks; the water that remains is carried off by the waterways and scuppers.

WAYS (SHIPBUILDING WAYS, LAUNCHING WAYS)—a term applied to the timber structure on which a ship is built and launched.

WEATHER—the side of a vessel or thing towards or against the wind.

WEATHER CURTAIN—a canvas protection attached to the bridge rail or to the side of the crow's-nest. These curtains are adjustable and can be raised up so as to form a protection to the men from the rain, weather or spray.

WEATHER DECK—an upper deck with no overhead protection.

WEDDING KNOT—a method of seizing shrouds, generally used at the deadeye.

WEDGE—a V-shaped piece of hardwood used for mechanical purposes. When the point of a wedge is driven into a crack, seam or crevice, a great pressure on the sides of the seam, crack or crevice can be produced and the edges can be forced or split apart. Very heavy objects can be lifted a short distance, with very little power, by means of this device.

WEEP—a slight water leak through a seam or around a fastening.

WELDING—the joining together of two metal parts by heating in a furnace or blacksmith's fire, fusing and forging them together, so as to make one continuous piece.

WELL (COCKPIT)—the boxed space at the bottom of the suction pipe of the drainage system of a vessel. Into this space the water drains from the hold.

WHALEBACK—a term applied to a peculiar type of vessel, the construction of which differs materially from other vessels, as follows: The vessels are built with sides running over until they connect with the main deck, and have no superstructure except perhaps on the bow or stern, where houses are built for the accommodation of the crew and mechanical equipment. These vessels have a large freight-carrying capacity.

WHEEL—the mechanical device or mechanism that is used to steer a vessel. Attached to one part of the wheel, when no steam steering-gear is used, is a horizontal drum or barrel around which are ropes leading to the tiller wind. Ropes from the starboard and port sides of the tiller are wound in the opposite directions around the drum, and by this means, when the wheel is rotated in one direction, the tiller-rope on one side is taken in and on the opposite side is payed out, or *vice versa*.

WHEEL-CHAINS—the chains used in place of rope connecting the steering-wheel with the tiller.

WHEEL-HOUSE—the house on the deck or bridge of a vessel which contains the wheel and which is used as a shelter from the elements for the quartermaster or the man in charge of the wheel.

WHEEL-RODS—lengths of straight rods with eyes forged at the end that connect the tiller with the steering-wheel. By use of these rods certain ropes or chains can be dispensed with, thus cheapening the cost of this part of the construction.

WHELPS—pieces of iron which are bolted to the wooden windlass, capstan, winch or hoisting engine barrel, so as to prevent the chain or wire fall from cutting into the wood.

WHIP—a purchase of one single tackle-block with a rope rove over the sheave. This is used for a light purchase or lifting. A double whip is fixed in a similar manner, but has two single tackle-blocks.

WHIP AND RUNNER—a tackle-block which is spliced into a pennant. One end of the whip is made fast and the bight is rove through the pennant block and the other end of the rope becomes the hauling part.

WHIP UPON WHIP—one whip applied to the fall of the other, thus considerably increasing the power.

WHITE LEAD PUTTY—a putty made of white lead, whiting and oil, used to fill deck seams of yachts and small boats.

WHOLE MOLDED—a term applied to the bodies of those vessels which are so constructed that one mold made in the mold loft section will mold all the frames in the main breadth or square body of the ship.

WILDCAT—a wheel of a winch or windlass capable of revolving with or on the shaft, having a periphery designed to receive and hold the links of the anchor chain or cable passing over it.

WINCH—a horizontal barrel that is turned by a crank or engine. On some sailing vessels a winch is fitted at the forward side of the mast, near the foot; it is used to hoist yards, gaffs and other heavy gear or tackle. When the power of a winch is mechanical, as a steam engine, it is usually called a hoisting engine or winch; when the power is obtained from a motor, it is called a motor winch.

WINDLASS—a mechanical device used to hoist anchors. This is generally located on the forecastle deck, although when guns are carried on the bow the windlass may be located below the forecastle deck in the forecastle.

WINDLASS BITTS—in a wooden vessel the upright support which carries the barrel of the windlass. These uprights are also called "carrick heads," "carrick bitts," "windlass heads."

WINDLASS CAPSTAIN—a combination of capstan and windlass, in which the windlass moves the spindle of the capstan by means of gearing.

WINDWARD—the side of a vessel against the wind.

WING—that part of the hold which is next to or against the side of a vessel.

WING-TRANSOM—the uppermost transom in the stern frame, on which the heels of the counter timbers are let in and rest.

WIRE RIGGING—standing rigging of wire rope, which has almost entirely taken the place of hemp, manila or other rigging of vegetable fiber on modern vessels.

WIRE ROPE—a rope manufactured from iron or steel drawn wires. For a given strength and weight the wire rope has a considerable advantage over manila, hemp or other vegetable fibre. Wire rope is laid up several different ways, according to the purpose for which the rope is to be used. Pliable hoisting rope is made with six strands of nineteen wires each. Standing rope is made of six strands of seven wires each. A wire rope is usually made of strands or twisted cords of wire laid up in the opposite direction to that in which the wires are laid up in the strands. In the lang lay, sometimes called the universal lay, the wires are laid into strands and the strands into the rope in the same direction. This sort of rope is used for the hoisting rope on elevators and mines and for transmission rope, where it is desired to secure a flexible rope. The iron and steel material used in wire rope is of three qualities, known to trade as *iron*, which in a one-inch diameter rope, has a breaking strain of sixteen tons; the *cast steel* rope, which in a one-inch diameter rope has a breaking strain of thirty-three tons; and the *plow steel* rope, which is of the highest tensile strength, and which, in a one-inch diameter rope, has a breaking strain of forty-seven tons. This applies to six-strand nineteen-wire flexible rope, with hemp core. Some rope is made of charcoal wire, although it is very much more expensive. The wire rope can be protected from the weather by coating or treating the wires before laying up in strands, in a hot galvanized bath.

WITH THE SUN—a rope which is laid up from left to right is said to be laid up "with the sun."

WOODLING—term applied to winding a rope tight around a spar after it has been fished.

WOOD-LOCK—a small piece of hardwood, or sometimes of copper, fitted above the upper pintle and against the after side of the rudder-post. This is used to prevent the rudder unshipping or being unhinged in a heavy sea.

WORKING JIB—a term applied to the jib, one of the head sails carried in ordinary weather.

WORKING SAILS—all the regular sails of a vessel carried in ordinary weather. This does not include sails which are carried in light breezes.

WORKING UP—to make spun yarn, marlin and small stuff out of strands of old rigging.

WORM—filling up in between the lays of a rope with windings of small stuff, marlin or spun yarn.

WRAIN BOLTS—eyebolts with large, loose rings, used to receive the end of the wrain staff when forcing planking in tight against the sides of the frames when fastening into position. The rings are welded loose into the eyes on one end of this bolt, the other end has two or three slots cut transversely and fitted with a removable key. When these are used they are inserted into holes bored clean through the timber frames or plankings. The bolt is inserted and the washer put over the end of the bolt and a key is fitted into one of the transverse slots. This effectually secures the bolt in position.

WRAIN-STAFF-STAVE—a long pole of tough wood, like hickory, tapered at the end, so as to go into the ring on the end of the wrain bolt. This staff forms a lever of great power, which applied against the face of a plank, forces it into position. Used for springing thick planking or timbers into position.

WRING—to twist or strain unduly; to wring a mast is to buckle it by setting up the shrouds too tight.

WYTHE—a double iron ring, like a figure eight, fitted at the end of a boom like a band with a ring. Through the ring a spar can be rigged out, extending the length of the boom. It is also called a "boom iron."

Y

YARD—a horizontal athwartship spar fitted to the mast, as a signal or wireless yard. In sailing vessels the yard is always carried on the forward side of the mast, but wireless yards are now carried sometimes on the after side of the mast, a considerable distance from the mast and arranged on springs, so that in an explosion of a torpedo or mine, which would lift the vessel amidships and strain or hog her, it would not carry away the wireless yard and bring all the gear down to the deck.

YOKE—a horizontal piece of wood or metal which is placed across the head of a small boat's rudder. In each end of the yoke a small line is attached called a "yoke line." By pulling and slacking alternate lines the rudder is turned and the boat is steered.

YOKE-LINE—a short piece of rope fastened to the yoke at the head of the rudder, which is used to turn the rudder and steer the boat.